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OTTAWA, CANADA

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As one of its major activities in carrying out its purpose, the Society publishes a monthly magazine, the Canadian Geographical Journal, which is devoted to every phase of geography—historical, physical and economic—first of Canada, then of the British Empire and of the other parts of the world in which Canada has special interest. It is the intention to publish articles in this magazine that will be popular in character, easily read, well illustrated and educational to the young, as well as informative to the adult.

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CANADIAN GEOGRAPHICAL JOURNAL

Editor - Gordon M. Dallyn

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This magazine is dedicated to the interpretation, in authentic and popular form, with extensive illustration, of geography in its widest sense, first of Canada, then of the rest of the British Commonwealth, and other parts of the world in which Canada has special interest.

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The British standard of spelling is adopted substantially as used by the Dominion Government and taught in most Canadian schools, the precise authority being the Oxford Dictionary as edited in 1936.

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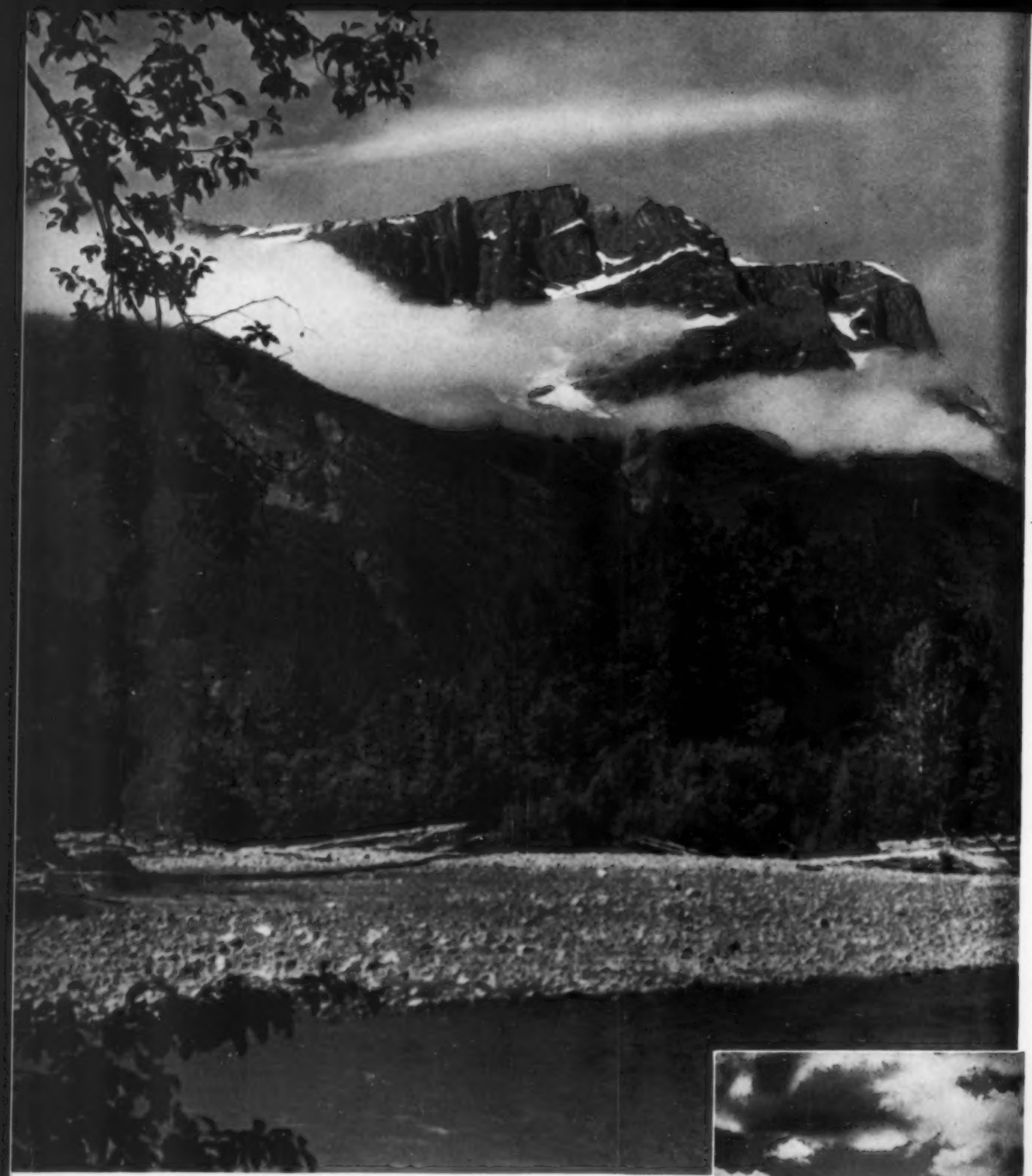
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Sir Alexander described this "Stupendous Mountain" in 1793; it rises 9,000 feet above Bella Coola River and was not climbed until 1937.

Right:—This panoramic view of the inland side of the Coast Mountains from the Rainbow Mountains covers a sector of about 60 miles. The foreground ridges are brightly coloured lava beds.



THE RAINBOW MOUNTAINS IN TWEEDSMUIR PARK

by **DON MUNDAY**

SCENIC splendour and historic glamour mark the southern entrance to Tweedsmuir Park, the newest and greatest mountain park in British Columbia; sea and mountains blend their charm at the mouth of Bella Coola River where the indomitable Sir Alexander Mackenzie ended the first crossing of North America in 1793 by a route passing through part of what is now Tweedsmuir Park.

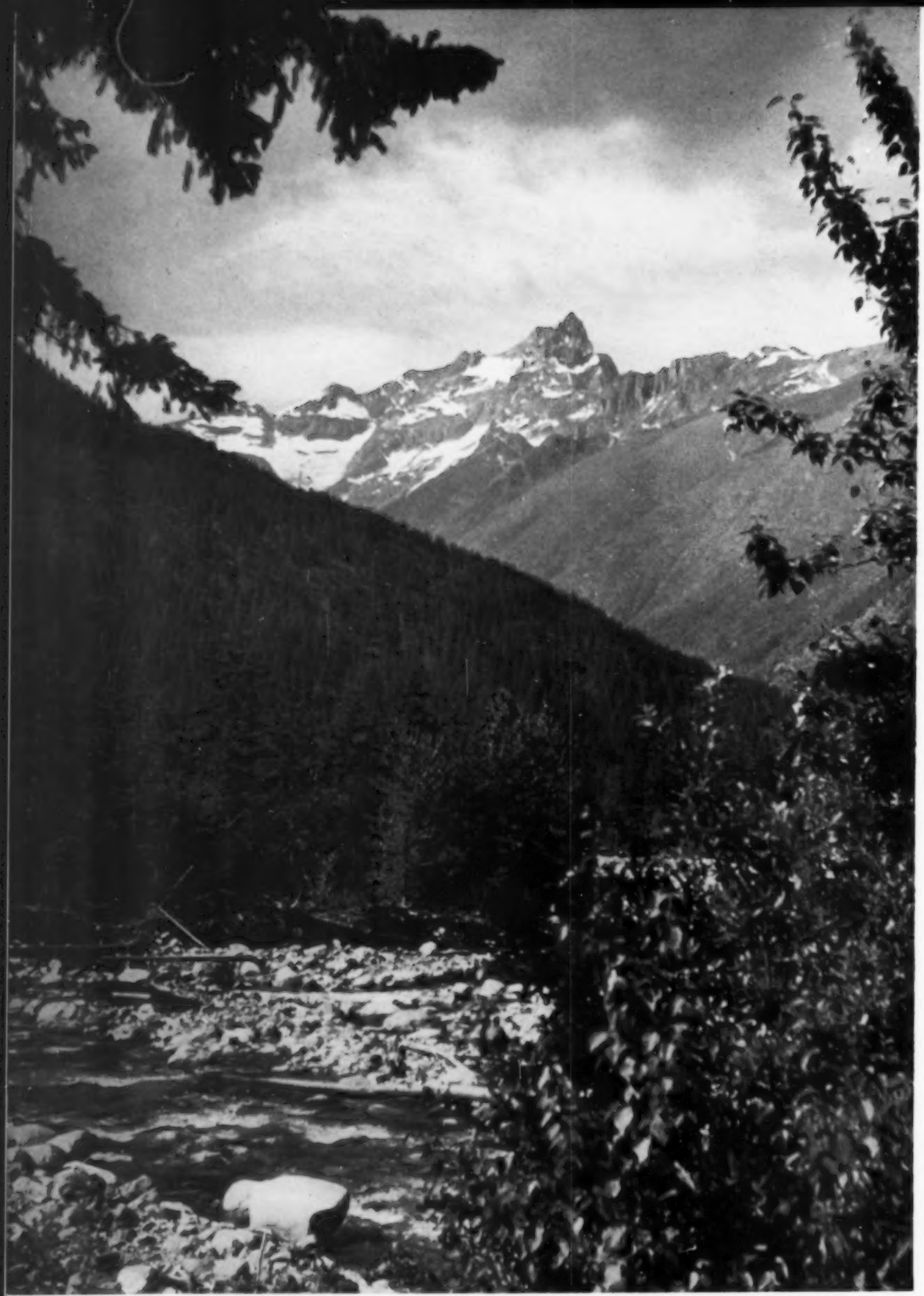
Trail construction in connection with Lord Tweedsmuir's visit to the park in 1937, resulted in the organizing of parties in 1938 to ride into the Rainbow Mountains which, apparently, are not yet widely known for their richly tinted volcanic rocks and their wonderful profusion of alpine flowers.

From Vancouver the *S. S. Cardena* carried us about 250 miles northward along the remarkable "Inside Passage" which is almost entirely protected from the somewhat misnamed Pacific Ocean by a barrier of islands; these are mostly mountainous fragments of the great chain of the Coast Mountains. But unless the traveller voyages to the heads of the fiord-like inlets which thrust silver arms deep into the range, he sees little evidence of the mighty peaks and immense snowfields. (See "Canada's Newest Mountains," Canadian Geographical Journal, December, 1932, and "Exploring Western Icefields," October, 1936.)

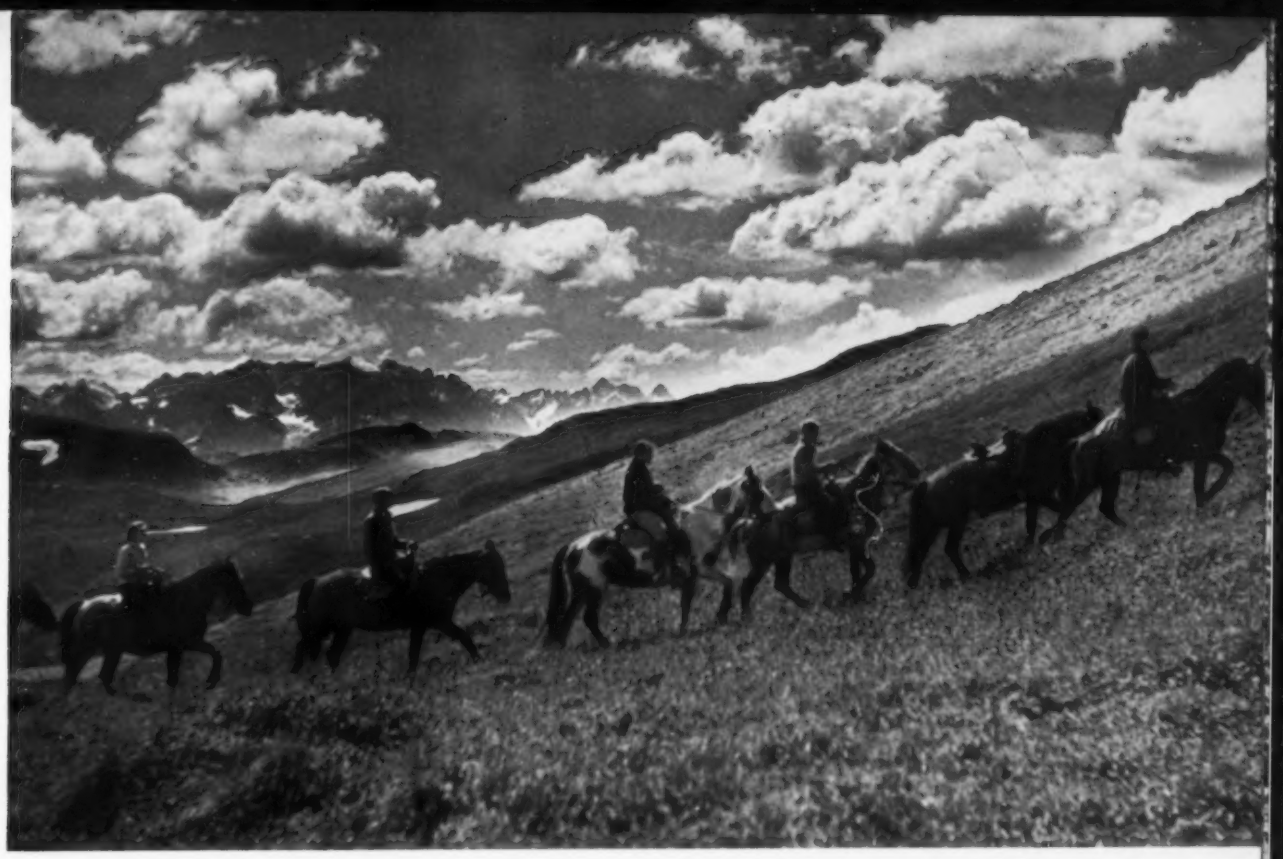
Turning aside, from the direct course to Prince Rupert, into Burke Channel the *Cardena* steamed 60 miles between precipices of increasing height. Before reaching Bella Coola a tantalizing glimpse along South Bentinck Arm reveals part of 25 miles of glaciers, pierced with spear-head peaks, which hang above this little known inlet.

In a landscape sculptured on a scale so grand, the present traces of civilization have imposed only relatively puny scratches since Mackenzie won his first glimpse of the Western Sea across the tide-flats of Bella Coola River. The fish-boats dotting North Bentinck Arm (and expecting the steamer to dodge between their overlapping nets) are now power-driven instead of being Indian dug-outs; instead of a long struggle upstream against the glacial turbulence of the river we will go by automobile 40 miles to Tweedsmuir Lodge. Instead of passing villages of hostile Indians we will see numerous farmsteads, many of them dating back to the Norwegian settlement established in 1893 under leadership of Rev. Christian Saugstad.





Down the canyon of Kahylskt (Burnt Bridge) Creek Mackenzie toiled to the "Friendly Village", near the base of Mt. Stupendous. The overgrown village site is down the left bank of the creek.



Near the head of Mackenzie Valley in the Rainbow Mountains the dominant feature is Mackenzie's "Stupendous Mountain".

There is much fine farm land in the valley, but distance from adequate markets is a problem. The Indian population is not large. In 1862 smallpox reduced the Bella Coolas from 800 to 15. Whites in the valley sometimes quote the Indians as summing up their activities: "In summer we fish, in winter we don't fish." It is not wholly true, and if it were it might be a severe indictment of the white man's wardship of the Indians.

Ko-om-ko-otz, the Indian village near the river mouth, was termed "Rascal's Village" by Mackenzie after he and his men narrowly escaped massacre. It long ago gave place to well built frame houses, but the tremendous flood which ravaged the valley about two years ago made it advisable to move to higher ground on the south side of the river — to which the white town of Bella Coola had already been driven by a previous flood. To the accompaniment of hymns and some measure of semi-savage celebrations, the Indians dragged their church on huge log skids across the river bed with powerful logging tractors.

Beyond the spire of the neat white church at Hagensborg, 14 miles up the valley, Mt. Noosatsum's mighty spire lifts in one great 9,000-foot sweep above the valley floor — a contrast between Christian faith and pagan myth, for Indian tradition asserts the summit was "the abode of an ancient chief and his squaw, who climbed there at the time of the Deluge and were saved to perpetuate their race."

Across the valley from Mt. Noosatsum an angular block of great size perches on a mountain sky line. According to Indian lore, it is a house an old Indian built to get away from the many grizzlies in the valley. (The day before we left for home a settler killed three bears which persisted in prowling practically through his dooryard where his small children played.)

Up-river 30 miles towers the only mountain Mackenzie singled out for special description. As he broke through the Rainbow Mountains he wrote, "Before us appeared a stupendous mountain, whose snow-clad summit was lost in the clouds," and, as his descent towards Bella Coola valley revealed the bases of the mountains, he added, "The country between them soon opened to our view, which apparently added to their awful elevation."

The base of Mackenzie's "Mt. Stupendous" is eight miles long and its precipices impend almost 9,000 feet above the now overgrown site of the "Friendly



Crater-like walls of richly tinted lava beds rim Mackenzie Valley with ramparts that touch the clouds. In the Rainbow Mountains even the talus slopes below the cliffs may shade from colour to colour according to where the fragments are derived.

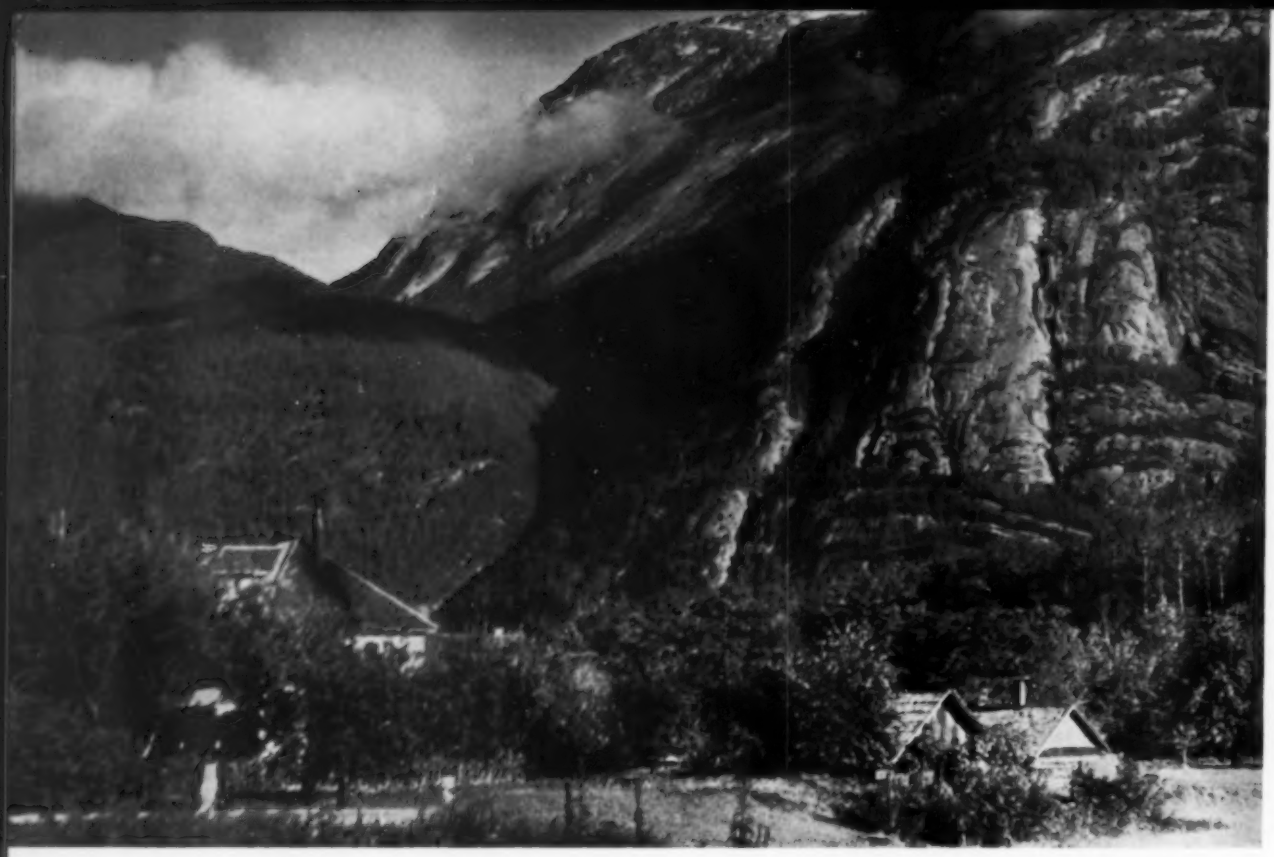
On the rim of Mackenzie Pass, in the footsteps of Sir Alexander Mackenzie in the Rainbow Mountains.



Leaving Atnarko Valley for the Rainbow Mountains and Tweedsmuir Park.

Crossing "Tommy's Pass", 6,000 feet, on Rainbow Mountains trail.





Granite precipices like this along Bella Coola Valley help explain why a settlement with so many people of Norwegian descent does not indulge in ski-ing.

Village" Mackenzie found at the mouth of the canyon of Kahylskt (Burnt Bridge) Creek after his exhausting descent of the gorge to the main valley.

Such mountains as Stupendous and Ncosatsum, for all their impressive heights, merely form outposts for greater summits glimpsed up wild tributary canyons along the valley. For the most part, the mountains are still nameless.

Near the end of the road and 40 miles from the river mouth we emerged from a forest of lofty Douglas firs to the old Indian village site of Stuie (originally nearer "Shtooiht" and meaning, possibly, "a place of refuge"). It was here that Lord Tweedsmuir rested for several days after exploring the northern part of the park named in his honour, and he gave permission to change the name of Stuie Lodge to Tweedsmuir Lodge. Our present plan was to ride into the Rainbow Mountains in the southern part of the park which time did not permit His Excellency's party to visit.

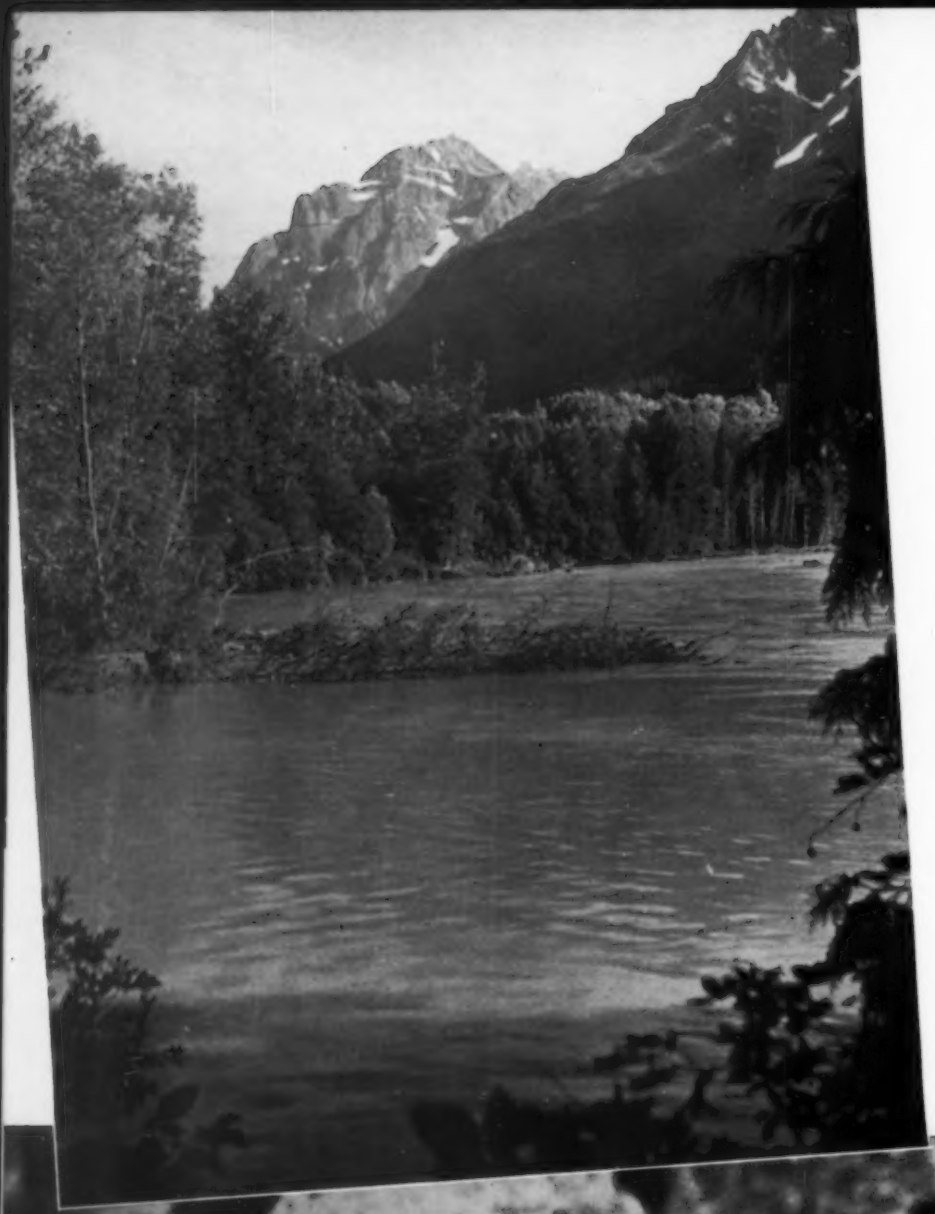
Like Fraser, Skeena and other great valleys opening to the Pacific, the Bella Coola valley evidently existed even before the mountain-building uplift of the Coast Mountains, and succeeded in cutting its trench down as fast as the land rose. As a result, Stuie is only 500 feet above sea level although just at the inland border of the main mass of the Coast Mountains, here about 100 miles wide, for the *Cardena* had brought us more than halfway through the great mountain chain in our voyage 60 miles along Burke Channel.

At Stuie, Bella Coola River divides; the Atnarko is a clear river draining mostly non-glacial plateau-like country eastward of the range. It is a notable trout stream, and in autumn grizzly bears congregate along it to fish for salmon, but even in summer one might about dusk see a grizzly by watching along the bank. The view up Talchako River suggested looking along the hull of a huge ship; 32 miles away, Monarch Mountain, 11,714 feet, closed the end of the valley. Henry S. Hall, the well-known American climber, found the Talchako's source to be a horseshoe-shaped glacier 15 miles long.

Mr. T. A. Walker, proprietor of Tweedsmuir Lodge, had assembled 20 saddle horses and five pack horses at the end of the road, with his partner, George Draney, in charge. Leaving the pleasant river behind, we zigzagged 4,000 feet upward, for the Atnarko valley, like the Bella Coola, is a typical U-shaped trough eroded by the



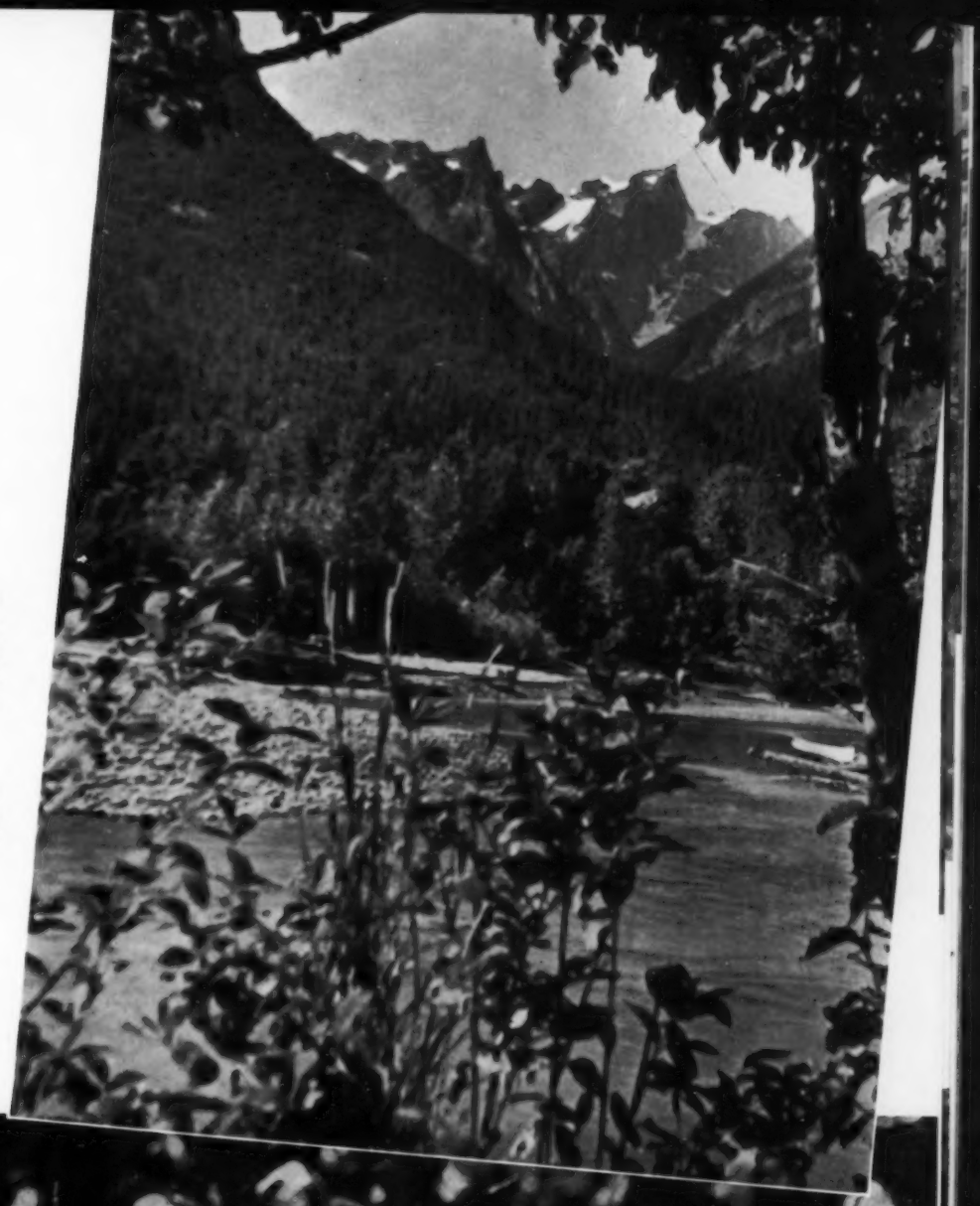
Unlike most coastal streams Atnarko River has good fishing all summer.
Mt. Melikan at Tweedsmuir Lodge.



More magnificent than the famous Fraser River Canyon, is the gorge Bella Coola River has cut through loftier mountains. Fertile alluvial flats border the river, and settlers' homes front such scenes as this. Glacial sources of the river guarantee the valley against ever becoming a "Dust-Bowl".



Mist Maidens (*Romanzoffia sitchensis*), a dainty dweller in the high mountains.



Every break in the mountainous walls of Bella Coola Valley reveals greater summits of the Coast Mountains beyond. These nameless peaks are up the Oriental-sounding Tsini-Tsin Creek.

White Rhododendron (*Rhododendron albiflorum*) is the showiest bush near timber line in northern mountains.





Pagan myth and Christian faith meet at Hagensborg. Traditionally an ancient chief and his squaw survived the Flood on Mt. Noosatsum, 9,000 feet above Bella Coola River, and so perpetuated the local tribe of Indians.

ice-sheets which covered British Columbia and also plowed out the multitude of lake basins of all sizes.

Views widened through slender jack-pines as we climbed towards airy alplands of a vast irregular plateau where alpine firs thinned and opened to park-like growth; between them spread acres of mountain rhododendrons, or more open ground given over to heather and alpine flowers. Broad ridges between wide shallow valleys gave spaciousness to the scene. Ponds and small lakes abounded, adding the magical power water exerts to enhance natural loveliness or even relieve a commonplace landscape of dullness.

We camped this night at an elevation of about 5,000 feet beside a lake in a long meadow. Perhaps distant fields look green even to a horse — relieved of pack and saddle, they mostly hurried to the far end of the meadow.

Eastward the eye ranged to blue distances of the famous Chilcotin ranching country. Somewhere across that boundless expanse we knew there ran Bella Coola's only land link with other provincial highways, a horse trail more or less following the course of an Indian foot trail that was ancient before the white man came. During Cariboo gold rush days the miners used it to some extent, and it was the scene of a murderous attack upon a pack train taking supplies for the ill-fated Waddington road from Bute Inlet, by Indians who had already massacred the road gang at Murderer's Bar on Homathko River.

Almost before our dunnage bags had been sorted from the pile of baggage and unpacked, Joe Goff yelled from the cook tent, "Come and get it!" He leapt into such sudden fame as a cook that a lady was heard inquiring wistfully, "Is Joe married?" Joe is. Thereafter Joe carefully insisted most of the cooking was really done by his capable helper, Bob Ratcliff. Bob is a good cook too, but when last heard of, was still single.

Mountain flowers flourish best at tree-line where few conifers maintain a footing. Through this bright profusion the trail wound gradually upward, round mountain shoulders to a windy pass over 6,000 feet high, opening a sudden view across a lake-gemmed valley to the Rainbow Mountains. Gloom of oncoming storm dimmed the



Fiord-like Burke Channel penetrates more than 60 miles into the Coast Mountains. Here Mackenzie completed the first crossing of North America.

rich volcanic hues, but Mackenzie Pass framed Mt. Brilliant which shone incredibly, a bright rose beneath a stray shaft of noonday sunlight.

We rode down past lovely lakes without names. Along rusty lava terraces in the valley bottom runs Capooce's summer trail —Capooce, an Indian trader, became in his own time almost a legendary figure, and, perhaps, was a thorn in the side of rival white traders. His trail led from Bella Coola valley to the head of Dean River. His sum of buried wealth probably lost nothing in the telling.

Beyond Capooce's trail our course passed lakes and lava ramparts and crossed endless uplands where massed and mingling colours of flowers caught the beholder's throat — and so into the head of Kahylskt Creek, rejoining Mackenzie's route.

The thunderstorm, darkening the rim of Mackenzie Pass ahead, tried to duplicate for advance members of our party such weather as made Mackenzie write that it was the "most distressing" he had experienced; but he had huddled hungrily in the lee of a rock while waiting long for hunters who returned without meat.

The crest of this pass, about 6,500 feet, was the highest point Mackenzie reached, but if he believed the Indian woman who had told him he would see the Pacific from the mountains, he was disappointed. Behind him 300 miles of wilderness lay between him and safety.

Northward from Mackenzie Pass the scene was almost unearthly; through flying storm clouds glowed naked mountaintops of ancient lava which Mackenzie described as appearing "as if fire had passed over them," while deep below us Kohasqanko Creek ran through Mackenzie Valley . . ." a beautiful valley watered by a small river", which delighted his trail-worn men.

Indians call the Rainbow Mountains "Tsitsutl," said to mean "the painted mountains", but rendering Bella Coola as "beautiful valley" strains credulity, though the name is not in itself inapt.

From a pleasant camp in Mackenzie Valley trips could be made to valleys, passes, lakes and peaks. Mackenzie survey station, 7,064 feet, commanded a hundred miles or more of the jagged peaks of the Coast Mountains, including in very clear



weather giant Mt. Waddington, 13,260 feet. (See Canadian Geographical Journal, December, 1932.)

Before being told that Alexander Mackenzie had nothing to do with placing the survey cairn on Mackenzie, a souvenir-hunter transported about 20 pounds of rocks all the way to Bella Coola!

I have never seen such scarlet concentrations of paintbrush as splashed the southern slopes of this mountain. Such barbaric splendour cannot fail to impress although more delicate tints are more beautiful.

Fred Perry, Vancouver botanist who made a botanical survey of the district, declared he never saw such variety and profusion in Canadian mountains.

Hamilton Laing, noted naturalist from Comox, B.C., spent a successful summer in the Bella Coola area collecting for the National Museum, Ottawa, securing an extraordinary variety of birds and mammals. He had left Rainbow Mountains out of his plans, but Mrs. Munday accidentally stepped on a yellow-backed "mouse". It seemed new to science—only Mr. Laing soon identified it as a lemming, generally thought of as living much nearer the Arctic Circle. The last I heard of Mr. Laing in the Rainbow Mountains he was described as pouncing on lemmings while his assistant, Charlie Guiget, rode madly through willow clumps to scare them out. I have little doubt that if we had told him instead that the "mouse" lived on top of the great peak which we had been exploring with a view to climbing (just prior to the trail-ride), he would have turned mountaineer long enough to try to get up the formidable mountain.

On our homeward trip down Dean Channel Capt. J. Boden for our benefit swung the *Cardena* within a few score yards of Mackenzie's Rock, which now bears a simple obelisk placed by the Historic Sites Board. Fortunately we were familiar with the account of the fine work done by Capt. R. P. Bishop, of Victoria, in definitely identifying the rock on which Mackenzie, 145 years before, painted in vermilion and melted grease the famous brief memorial: "Alexander Mackenzie, from Canada, by land, the twenty-second of July, one thousand seven hundred and ninety-three."

Looking at that lonely rock, one is dull of soul who does not feel some stirring of the spirit of courageous pioneers who carried the boundaries of Canada to the Western Sea.



7,000-foot cliff overlooking the route by which Sir Alexander Mackenzie descended from the present Tweedsmuir Park to Bella Coola River during the first crossing of North America in 1793.



The head-post at a grave near the site of the "Rascals' Village", where Mackenzie and his men nearly lost their lives on their homeward trip.

Mackenzie's Rock, Dean Channel, from the steamer. The steep, smooth face almost below the monument is probably where Mackenzie painted with grease and vermilion his famous inscription "Alexander Mackenzie, from Canada, by land, the twenty-second of July, one thousand seven hundred and ninety-three".







Above:—

Monarch Mountain, 11,714 feet, closes the vista 30 miles up Talchako River which is the main branch of Bella Coola River and drains a glacier 15 miles long.

Right:—

Naturalists and mountaineers agree that the new trail to Rainbow Mountains in Tweedsmuir Park is unequalled in Canadian mountains for luxuriance of alpine flowers. Rainbow Mountains form the largest range of volcanic mountains in Canada.





Left:—

Ferrying Lord Tweedsmuir's party across a small channel of Bella Coola River to the site of the former "Rascals' Village". Mackenzie descended the river in a similar canoe.







Top Centre:—Bella Coola Valley rejoices still in virgin forests of giant fir and cedar, some of them the same trees at which Mackenzie's men marvelled 145 years ago when put ashore to lighten canoes being forced upstream during the homeward journey.

Above:—

On Tweedsmuir Park trail, with a background of nameless unclimbed peaks of the Coast Mountains. The alplands in the foreground are not known to be excelled anywhere in Canadian mountains for luxuriance of flowers.

Above:—

Retreating storm shadows reveal Mackenzie Valley in the Rainbow Mountains.

Right:—

Beyond the Rainbow Mountains extends the wilderness through which the indomitable Mackenzie and his men marched on short rations to find the Western Sea. The Indians' "Salmon House" was on Dean River in the direction of Tsaydaychuz, the snowy mountain at the left.





Miss Lorene Squire of Harper, Kansas.

LORENE SQUIRE STUDIES PRAIRIE BIRDS

by **HOYES LLOYD**

A VERY few years ago a young lady on the Kansas prairies gave up duck shooting as a bad job and took to hunting with a camera. So far as known her exact reasons for the change have not been stressed, but her camera results prove that lack of patience was not one of them. Then a few of her flying bird pictures were published, but it was not until the "Second North American Wildlife Conference" at St. Louis, Mo., in 1937 that Lorene Squire sprang into sudden fame. At this conference she appeared with over a hundred bird photographs which literally stopped traffic in the halls. "Ding" Darling, the conservationist and cartoonist, openly expressed his admiration for the work exhibited; Miss Squire met the representatives of the Canadian Prairie Provinces and was assured of a welcome in Canada; and by early summer she had attained her ambition to come to Canada and photograph birds. When she did come she held the title of official photographer to the "American Wildlife Institute", worthy successor to the American Game Association, and a power for conservation throughout the continent.

At a time when youth wonders what it can do there is a lesson in the meteoric rise to fame of a young woman who devoted herself to one task and did it well. Miss Squire has certainly seen a lot of Canada in her past two summers as an ornithologically inclined tourist. 1937 was spent in the prairie region, where waterfowl and shore birds give the prairies a unique tourist value, and where to the naturalist, every prairie slough can be an adventure. Her travels carried her to Chipewyan, Alberta, and the waterfowl region of the delta of the Peace River. In 1938 she journeyed to the delta of the Mackenzie River, and then from Churchill, Manitoba, sailed north with the *Nascopie* on the Arctic patrol to the islands of Canada's eastern Arctic Archipelago. Her return journey included a stop to study the Greater Snow Geese near Quebec.

Her technique is to use the small rapid-fire type of camera that has recently become so popular. These cameras cost little to operate because many exposures may be made without using much film. They are invaluable for photographing flying birds because of their rapidity of action, and their depth of focus not only improves the resulting photograph by giving a recognizable background but tremendously increases the odds that the flying bird will be in focus once it is snapped. Lightness of this equipment will be appreciated by all who have carried heavy cameras in marsh or wilderness.

Canada's prairie bird life is unlike that of any other part of the Dominion. One must visit the prairies to see many kinds of birds which are seldom found outside a prairie habitat. The prairies have their own songsters among the birds:—what prairie dweller does not love the western Meadowlark with his boastful song "I came here a thousand years ago". The Chestnut-collared Longspur, the Lark Bunting and Sprague's Pitit are all birds of the open spaces and all famous for their songs; in fact the Pipit is a rival of the Skylark, only awaiting a Shelley or a Wordsworth to make its song immortal.

The prairies are famous as the great duck-nesting area of the continent. They are the home of many different kinds of wild ducks some of which are very abundant. Recent drought on the prairies affected the continental water fowl supply because it is the habit of the prairie ducks, following well-defined routes, to spread out over much of the continent on their migrations. Some kinds of prairie ducks suffered when their home ponds dried up because their range had little territory outside the prairie region. Among these was the Canvasback, the map of whose summer and winter range shows a comparatively restricted nesting area.

Miss Squire took the charming portrait of downy baby Canvasbacks at North Battleford, Saskatchewan. All bird babies have an appeal of their own, and if any one

Bird pictures in this article are from the book "Wildfowling With a Camera" by Lorene Squire, and are published by consent of the J. B. Lippincott Company and the author.

doubts this, he should study the expression of these ducklings. The picture can also be taken as showing how prolific nature is, and how depleted stocks will increase if suitable habitat is provided and protection offered wild species at the critical time of increase.

The portrait of the flying Marbled Godwit shows another prairie dweller that will give a thrill to those who do not know the larger shore-birds. It can be found on the muddy shore of a prairie slough, and its nesting place is on the prairie sod nearby. Like most of the large shore-birds it is greatly depleted in numbers, the changing conditions on its nesting grounds, from prairie grass to agriculture, have no doubt tried it sorely; and its long journeys to its wintering-grounds, which extend from the Gulf of Mexico and California southward to Ecuador and Peru, are a hazard in themselves. The prairie sloughs would be strangely silent without its hearty shouts of "Eradika radika radika, correct, correct, correct". May it long live to return to its Canadian homeland and may it always be welcome. In Canada this species, with most of the shore-birds, is protected at all times by the Migratory Birds Convention Act.

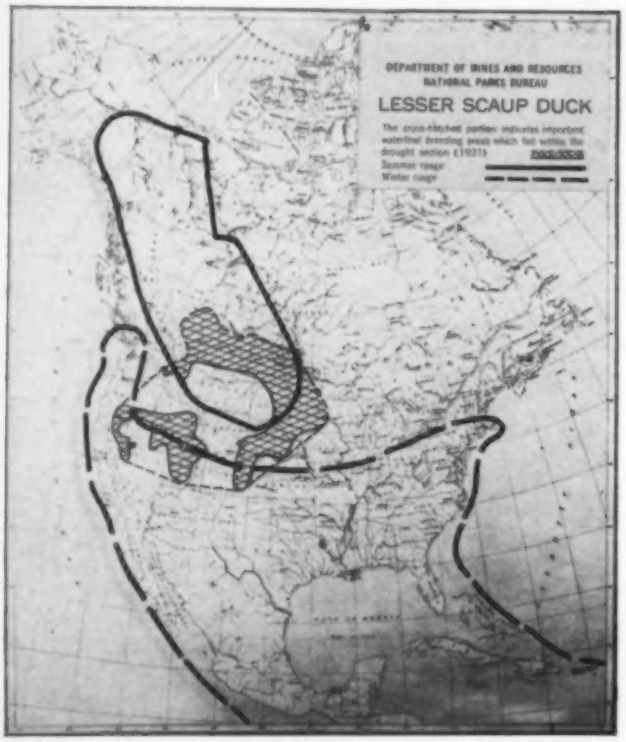
The hunter classifies the Greater Scaup and the Lesser Scaup Ducks together as "Bluebills" and sometimes even includes the Ring-necked Duck for good measure.

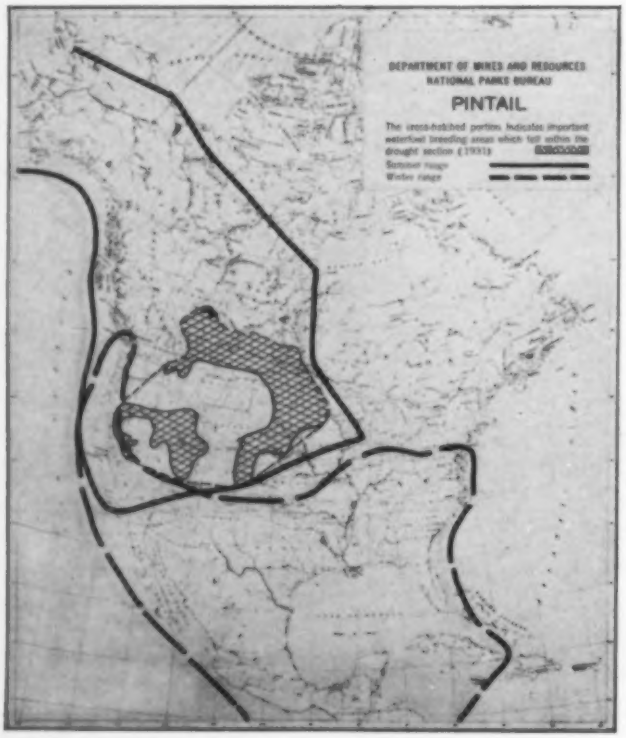






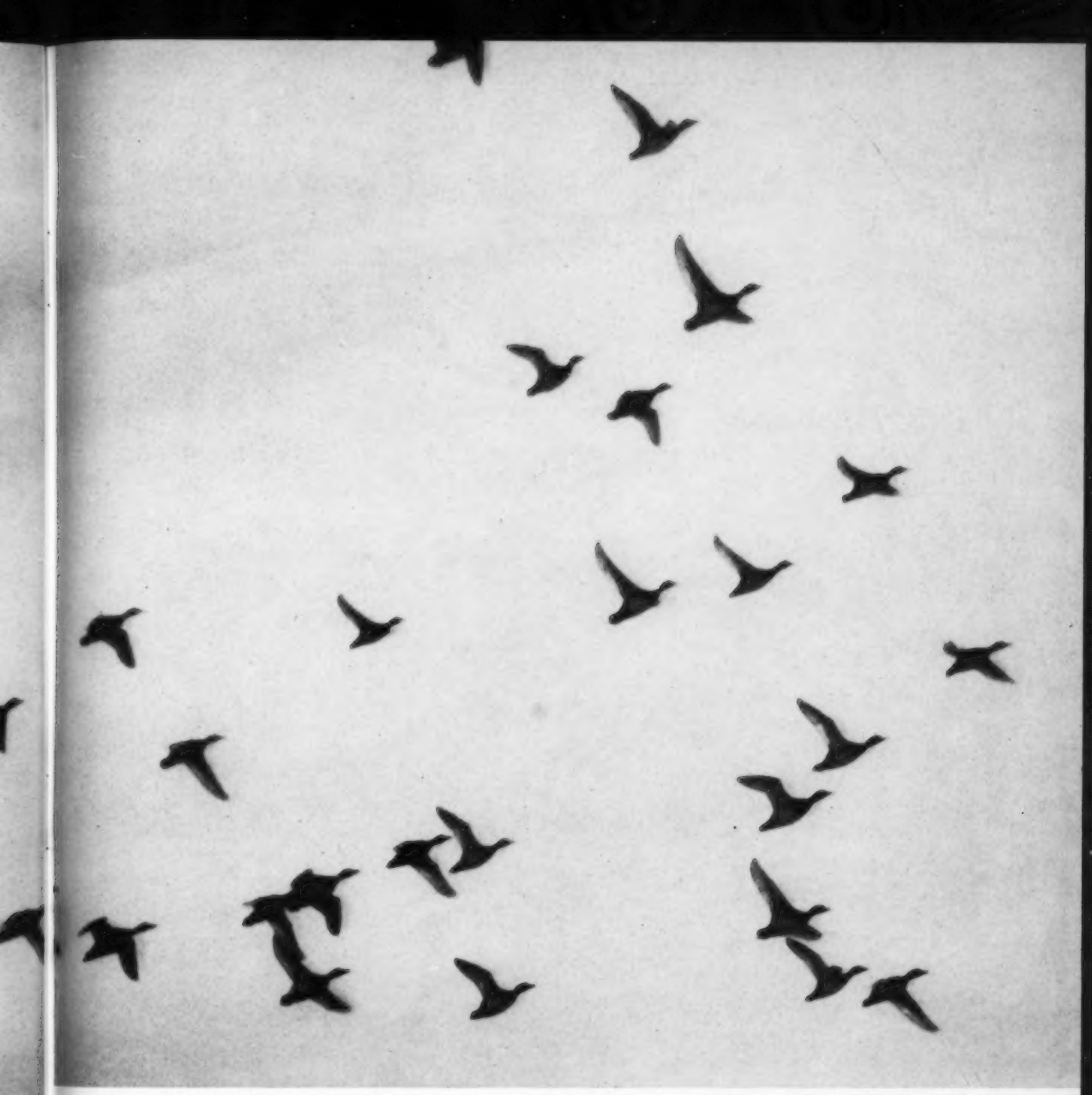
"Octuplet" Canvasbacks, North Battleford, Saskatchewan.







The common "Bluebill" of the prairies is the Lesser Scaup and that is probably the kind that the photograph shows. A glimpse at the range map for the Lesser Scaup Duck indicates what a traveller it is, and as the hunter of Ontario and Quebec knows, it migrates across a part of Eastern Canada on its journeys from the Prairies to the Atlantic, and back again. Hunters in Eastern Canada who look for the fall flocks should always remember that the



Bluebills, Ile-a-la-crosse, Saskatchewan.

continuance of their sport may depend on conditions a thousand miles away, in some other province.

The Pintail is one of the hardiest and most adaptable of all Canada's duck travellers. Its summer and winter range together include most of North America, and it is found in the Old World as well. This extensive range is a safeguard to the species that others dependent on more restricted areas lack. Verily the Pintail does not keep all its eggs in one basket.

Our tourist photographer from Kansas is doing a great service by showing Canadians and others the charm of prairie bird life. The prairies have a special bird life all their own, and any who wish to see the birds of the prairies must visit them. As a tourist attraction the birds are of ever-increasing importance, for the bird-conscious people go where the birds are. Public interest is the basis of good conservation, and the wild life conservationist is glad to see that interest grow.



Above: Marbled Godwit, North Battleford, Saskatchewan.
Right: Pintail, North Battleford, Saskatchewan, makes a three-point landing.




OIL LINES
DANGER NO SMOKING

ASPHALT INDUSTRY OF TRINIDAD

by **W. FRANKLIN HARTZELL**

IN search of El Dorado, the land of gold and treasure, Sir Walter Raleigh set out from the Old World in 1595 and landed on the coast of Trinidad, which had been discovered nearly a century prior to that time by Christopher Columbus.

The intrepid British explorer landed at a spot on the coast line, where he found not the precious metal which he sought, but an overflow of asphalt from the famous asphalt lake which had reached down to the sea. Sir Walter examined the asphalt which he described as "stone pitch," used it to caulk his leaky ships and continued on his way in search of gold.

In writing of his visit to Trinidad and his discovery of asphalt, Sir Walter Raleigh recorded the following in his log:

> "I left the shippes and kept by the shore the better to come to speack with some of the inhabitantes and also to understand the rivers, watring places, and portes of the Island . . . from Curipan came to a port and seat of the Indians called Parico . . . from thence I rowed to anchor port called by the natives Piche and by the Spaniards Tierra de Brea. At this point called Tierra de Brea or Piche, there is that abundance of stone pitch that all the shippes of the world may be therewith laden from thence, and wee made triall of it in trimming our shippes to be most excellent good, and melteth not with the Sunne as pitch of Norway, and therefore for shippes trading South portes very profitable."

Little did he realize that the "stone pitch" or Trinidad asphalt that he had discovered would some day have great commercial value.

Two and three-quarter centuries after Raleigh discovered Trinidad Lake Asphalt, the first asphalt roadway was laid in Newark, N.J., under the direction of Prof. E. J. De Schmedt, a Belgian chemist. That was in 1870. The following year Trinidad asphalt roadways were built in New York.

This new type of pavement was an immediate success, and asphalt taken from the asphalt lake in Trinidad has since been used to pave many of the world's finest streets and boulevards, including Thames-Victoria Embankment, London, and miles upon miles of smooth, resilient, durable highways through the Empire.

Travel where you will through the far-flung British possessions, and you will find tarpaulin-covered drays or lorries hauling this dull black, flour-like material. Almost every one has seen it dumped steaming hot on the street; paused to watch the men shovelling and raking it out carefully, and have also been interested in the chugging rollers ironing it out into a smooth pavement.

In recent years, however, cold-laid mixtures, of which Trinidad Lake Asphalt is the important ingredient, have been used in roadway construction. These black paving mixtures are not composed wholly of asphalt as is sometimes supposed. Only ten or twelve per cent of it is asphalt, and the balance is sand or powdered limestone, with sometimes crushed stone as an ingredient. Nevertheless, Trinidad Lake Asphalt has such cementitious qualities that it converts these loose minerals into a solid sheet of material nearly as hard as rock.

Some one has aptly said that you could find parts of Trinidad scattered the world over, and this is really a fact because one can find Trinidad asphalt pavements in India, New Zealand, Straits Settlements, Australia, Egypt, Jamaica, South Africa, republics of South America, the West Indies as well as the British Isles, Canada and the United States of America.

Since asphalt was first used for street paving, chemists have discovered other uses for it. For example, it is now used in the manufacture of asphalt shingles and roll roofings. Asphalt is waterproof, and at the same time so tough and durable that it is peculiarly suited for that purpose. These qualities, combined with its low price, have no doubt been mainly responsible for its phenomenal success and popularity among builders and home owners.

The earlier forms of roll roofing were supplemented very soon by more elaborate styles coated with mineral granules in different colours, and cut into shingles in a wide variety of sizes and patterns. Within the last ten years, asphalt shingles have been so perfected that they rival even the expensive slate, tile and asbestos roofs in beauty and attractiveness.

Left:—Loading Asphalt at San Fernando.

Thousands of tons of native lake asphalt are used annually in the construction of built-up roofs and asphalt mastic floors for large office buildings and industrial plants.

But now let us turn our thoughts to the discovery of Trinidad, and learn more about this romantic island which lies in the waters of the deep blue Caribbean.

A sailor perched in the main top of the Spanish caravel which led Columbus' fleet on its third voyage to America sighted the land. It was on a hot mid-summer day—July 31, 1498—that he saw off in the distance to the westward three hazy peaks on a tropical island. Columbus and his men, wearied by the long, tiresome trip across the seas, were overjoyed at the sight of land. They offered prayers of thanks, and Columbus, in pursuance of a vow given to King Ferdinand and Queen Isabella, named the newly discovered land "La Trinidad."

While Columbus gave the name of Trinidad to this new land, the Indians whom he found there called the island "Iere" or "The Land of the Humming Bird," by reason of the large number of these colourful birds which are still to be found in the bright, warm sunlight of the tropical island.

The Island of Trinidad lies 700 miles north of the equator and 1,974 miles from New York. Its area is 1,755 square miles. Trinidad is separated from its nearest neighbour, Venezuela, by the great Gulf of Paria and the narrow straits or *bocas* which connect the gulf with the ocean.

Port-of-Spain, its capital and the largest city, is busy with the arrival and departure of steamships bearing the island's tropical riches to world ports.

One finds in Port-of-Spain a cosmopolitan population, consisting of English, French, German, American, Chinese, Negroes, East Indians and representatives of many other nations. The most popular hotel in the city faces the great Savannah, a wide stretch of lawn. There are beautiful drives to the reservoir; up the mountains to Maracas waterfall, with a vista of the Caribbean Sea, a thousand feet below; through avenues of giant bamboos arching over the roadway, and through miles of plantations of cacao.

Railway lines run east from Port-of-Spain, and south for thirty-five miles down the coast of the Gulf of Paria, to Prince's Town and San Fernando, through sections crowded with East Indian coolies.

One of the most interesting spots to be found on the Island of Trinidad is the "pitch lake," better known, perhaps, in the Dominion of Canada, as the Trinidad Asphalt Lake.

Located on the highest part of La Brea Point, Brighton, it is about fifty-eight miles by automobile from Port-of-Spain, and may also be reached by taking a steamship which leaves San Fernando daily for trips along the coast.

The steamer skirts along a shore bordered by mangrove swamps to Brighton, where visitors may go ashore at the long pier.

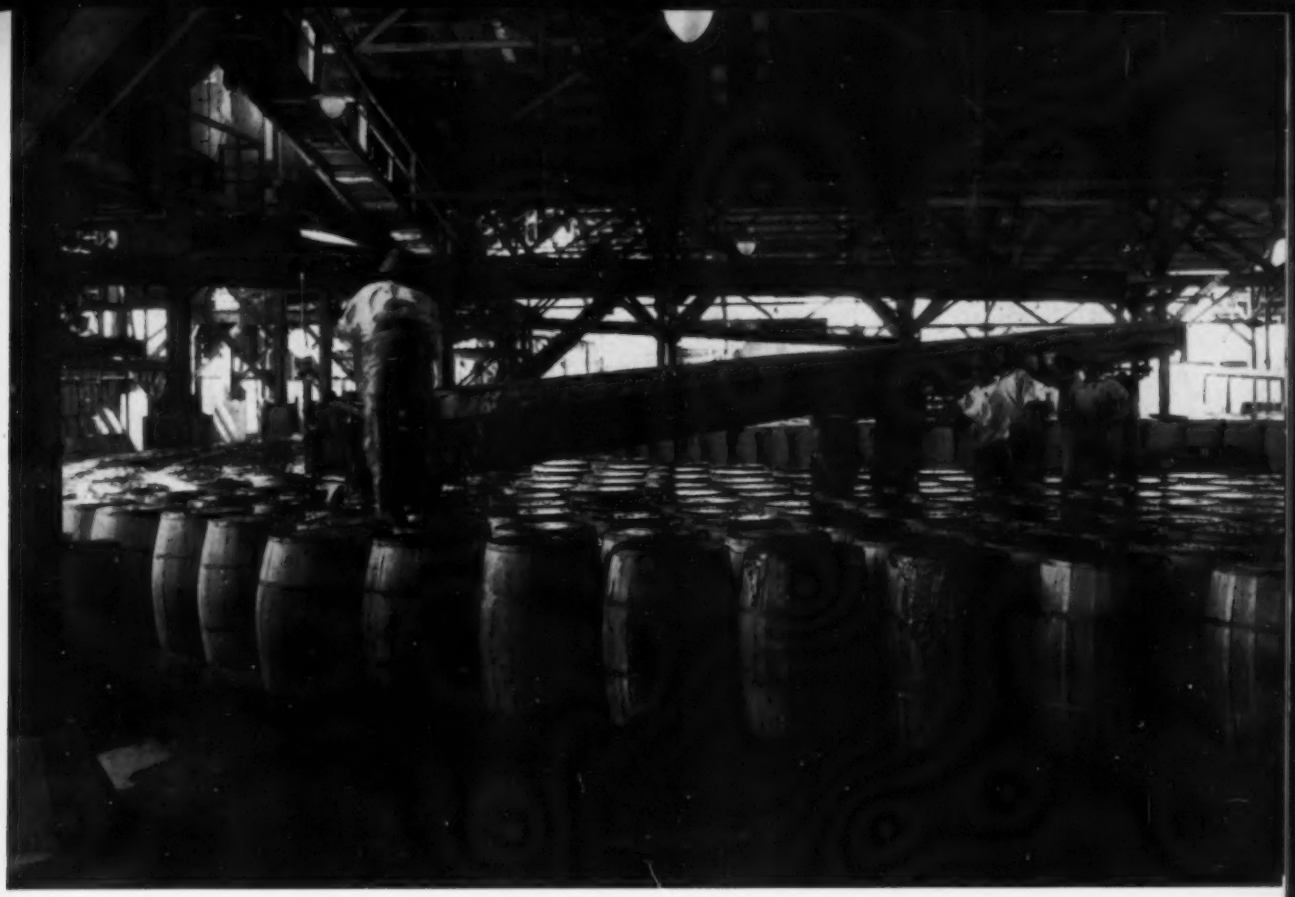
Brighton is the centre of the native lake asphalt industry. It is an active little industrial community close to the Trinidad Asphalt Lake, which is visited by thousands of tourists every year. On the way up the hill one sees many buildings, including the offices of the asphalt company, quarters for the executives, a recreation building or club house with tennis courts adjoining, a nine-hole golf course nearby, used by the employees of the company and others in the colony.

Upon reaching the rim of the lake, the visitor sees a grayish black mass with an area of 114 acres spread out before him. Sir Frederick Treves has compared the surface of the asphalt lake to the skin of an elephant, and the irregular creases to the folds in his hide. These folds are filled with water from the tropical rains. Here and there on the lake and along the edges of the pools of water are found the scrub trees, whose roots or stumps gradually sink or find their way into the asphalt, never growing to a greater height than eighteen feet.

You may walk where you please on the asphalt. Although some parts of it are soft, and your feet will sink in the grayish black mass for a fraction of an inch if you stand in any one place for any length of time, there is no danger of getting stuck in it.

Close to the edge of the lake the asphalt is drier while, along the shore of the lake and in a ravine passing through the village of La Brea and continuing down to the sea, there are deposits of asphalt known as "land" asphalt.

These deposits are composed of hard, dried-up residues that do not flow, and are probably the result of an overflow of oil,



Barrelling Trinidad Asphalt at Trinidad, B. W. I.

Courtesy of S. J. Hayward

Natives digging and loading crude Trinidad Lake Asphalt.



which during some earlier period of time has evaporated and hardened. Such deposits are also found in other parts of the island, but are too small to be commercially important; and furthermore, land asphalt contains much dirt, sticks, dead leaves and other foreign matter.

During mining operations at the Trinidad Asphalt Lake, bones and fossils are frequently uncovered. Some specimens which were found recently were sent to the Academy of Natural Sciences, in Philadelphia, Pa., for examination, and the following extract from the annual report of the Museum of Natural Sciences is not only interesting, but throws some light on the animal life in Trinidad in prehistoric times:

> "The two-bone fragments and the tooth represents the mastodon, a form of the elephant group and related to the mammoth. The fact that such animals once inhabited Trinidad is very interesting and indicates that further collecting and study would add much knowledge to the problem of distribution and the early migration of large animals from North and South America."

It is reasonable to assume that these monsters roamed through that wild country in ancient times, when the contents of the lake were in a semi-fluid state, and the animals that walked upon the surface sank into it because of their tremendous weight.

During February of 1928, a tree, believed by scientists to have been buried in the asphalt lake between four thousand and five thousand years, appeared, and disappeared a month later, and may never be seen again.

The tree came through the surface of the lake in a perfectly upright position, and continued to rise until the trunk stood six feet above the surface. This unusual occurrence was noted by those in charge of mining operations at the lake, and workmen sawed pieces from the top of the tree for specimens.

For a number of days the tree remained perfectly stationary and then commenced tilting slightly to one side. This tilting continued until the tree was standing at an angle of thirty degrees, when it started to sink into the asphalt again. Within a few days the tree had completely disappeared beneath the surface of the lake. All of this—the appearance and disappearance of the tree—occurred within a month, and no signs of it have been noted since its disappearance.

Scientists tell us that the lake is constantly shifting in what they call waves, flows or currents. This motion, of course, is very slow, but any body placed on the surface of the lake will shift its position from day to day. The movement of the tree proves that the mass of asphalt in the lake is not only moving on the surface, but more or less throughout its entire depth. The motion of the asphalt is similar to the movements which take place in a large pan of baker's dough, when it is set to rise. They are slow, constant, and do not follow any course of direction.

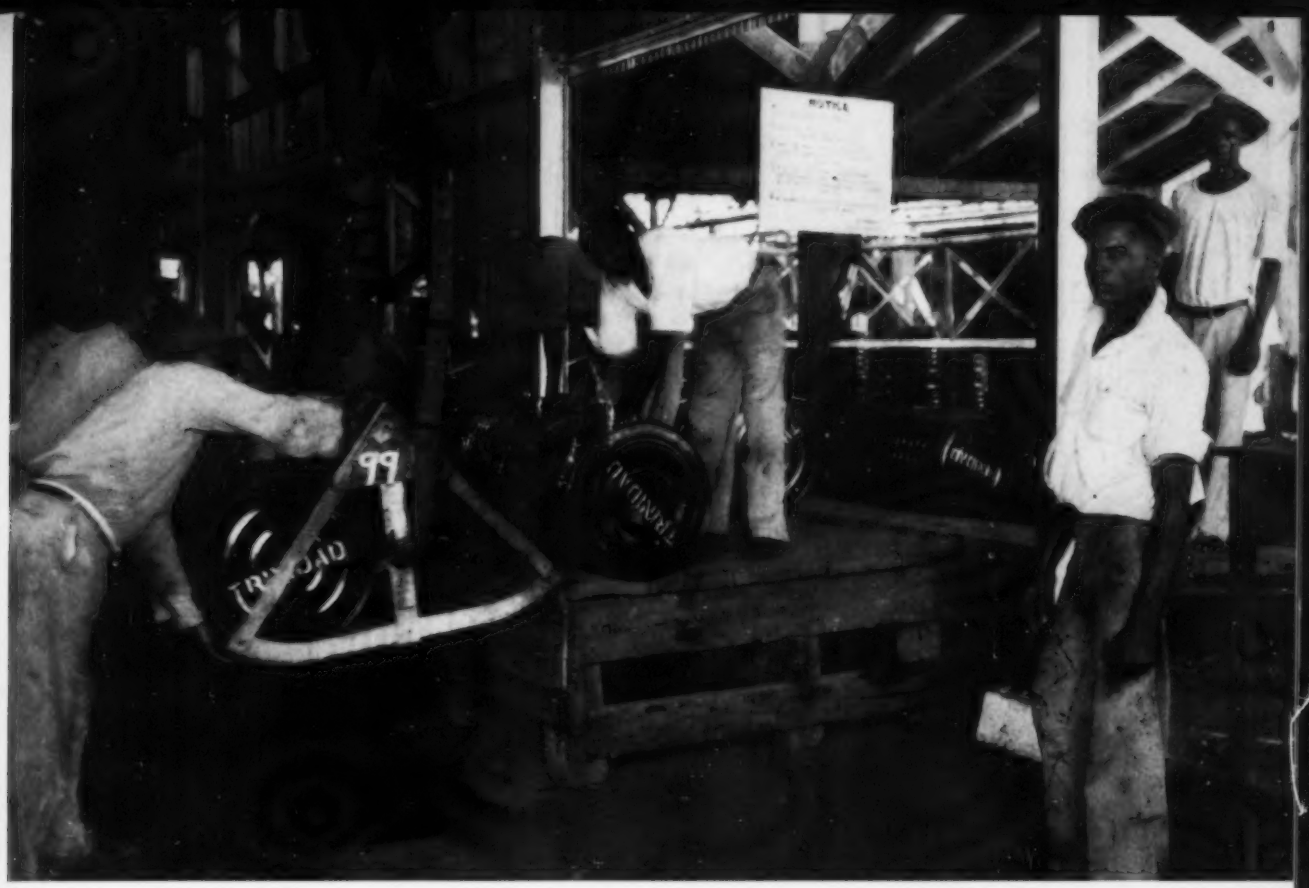
It would seem that the stem of the tree was caught in one of the downward flows or currents, which caused the tree to tilt until it stood more or less at an angle, the pull exerted by the downward current being sufficient to overcome friction, and the tree gradually sank and disappeared from sight.

The origin of the asphalt lake is still a subject of discussion among scientists. It is accounted for by a legend which was told in the distant past by native Indians. According to this legend, a tribe of Chayma Indians built their palm-leaf huts on the very spot where the lake now lies. Having been victorious in battle with neighbouring tribes, the Chayma celebrated, and being blind to an ancient superstition that humming birds contained the souls of the departed, killed these feathered jewels in quantities, ate them, and bedecked themselves with the plumage.

The "Great Spirit," greatly angered by this wanton slaughter, and as a punishment, caused the earth to open, and the entire village, with all of its wicked people, sank into the earth. Thereafter the cavity filled with asphalt, completely burying the entire village and its population, which, according to the legend, is still at the bottom of the asphalt lake.

While early writers, who produced highly imaginative narratives, and who probably never visited the Island of Trinidad, have described the asphalt lake as a possible inferno—a place of insufferable heat and fetid vapours—scientists now have a better understanding of its origin. They tell us that the asphalt lake had its origin many thousand years ago, during a period of general earth movements in the immediate vicinity of Trinidad, resulting in numerous earth fractures or faults.

At least one of these, we are told, was of sufficient depth to reach a large oil and



Drums of Trinidad Lake Asphalt ready for shipment to different parts of the world.

Courtesy of S. J. Hayward

Cable-way leading from the asphalt refinery to loading pier, Trinidad, B. W. I.



gas reservoir below the earth's surface, thereby providing a channel of escape for the oil and gas to the surface. Geologists also tell us that agitation caused by the escaping oil and gas gradually wore away the surface clays and earth, until finally a large, conical-shaped basin, known to-day as the asphalt basin, was formed.

Great quantities of escaping oil collected in this basin, we are told, the excess overflowing the rim of the basin and running into the sea.

This action, geologists say, occurred when the lake was in a more liquid state; when the influx from the underground was greater than the evaporation, with the result that the basin overflowed. In the course of time this overflow, being shallower, and therefore having a greater proportion of surface exposed to the direct rays of the sun, has resulted in the small deposits previously described as "land" asphalt. Over a long period of time the more volatile portions remaining in the basin were evaporated through natural processes, leaving the high-grade deposit which has come to be known as Trinidad Lake Asphalt.

Digging asphalt is a simple operation. A mattock is the only tool required, and under its blows the asphalt breaks readily. The crude asphalt, as broken, is brownish, usually quite wet with surface water, and filled with cavities, made by gas, up to an inch or more in diameter.

Mainly negroes are employed in the operation. They are organized into gangs consisting of one digger or pitch cutter, and five helpers, whose job is to pick up pieces of asphalt that have been cut and place them in the cars which are standing close by.

These men are skilled in the work and carry lumps of asphalt weighing from forty to one hundred pounds on their heads. These carriers are called "headers," because of the method of carrying the large chunks of asphalt.

A narrow gauge railroad runs from the terminal out over and halfway across the lake. Then it swings back in a great loop to the shore. Little cars, which carry the buckets, run on the tracks, drawn by a wire cable guided by rollers between the rails. After these cars have been filled they are drawn around the loop.

When the crude asphalt is to be shipped to the pier, the cars are halted under a conveyor cable. Very rapidly the hooks suspended from the cable are swung into place. The big bucket is then lifted from the truck and goes down the hill. The carriers are clamped to the moving cable, all of the buckets moving at the same rate of speed. The weight of those going down helps to pull the empties back again, so that very little power is needed to keep the cable moving.

The trains of dump cars used for charging the stills at the asphalt refinery alternate, one going up and dumping while the other is loading. Haulage is provided by a single cable, which pulls the train up the steep incline to the stills or driers. After dumping the cars, the trains run back by gravity, pulling the cable with them. When the empty train arrives at the lake, the cable is uncoupled and attached to the loaded train which is standing ready, and the operation repeated.

Reference has been made to the stills at the asphalt refinery, and it should be explained that the refining of Trinidad Lake Asphalt consists mainly of driving off the water which is found in it on being taken from the lake. The crude asphalt is dumped into stills or large tanks heated by coils of steampipe; the asphalt softens and boils, evaporating the water completely. The melted asphalt, then known as refined Trinidad asphalt, or dried asphalt, is drawn into barrels for shipment.

For direct shipment, the crude asphalt is dumped into the hold of ships at the pier and sent to other lands to be refined. During the voyage the asphalt congeals in a compact mass, and upon reaching its destination must be extracted from the hold of the ship, in much the same way as it was originally dug from the lake.

After removing a quantity of asphalt from the lake, the same spot, the following day, may look a little rough, but will be approximately level with the remainder of the lake. The hole fills up and in the course of a week all traces of digging are obliterated. This does not indicate there is an influx of new material into the lake equal to that taken out. While it is

true that in a small area near the centre of the lake, usually referred to as "The Mother of the Lake," the asphalt appears to be fresh and is quite soft, as compared with the asphalt taken from other parts of the lake, the influx s not appreciably great. It is generally believed that the softer condition of the asphalt at the centre is caused by a higher percentage of gas in this particular area.

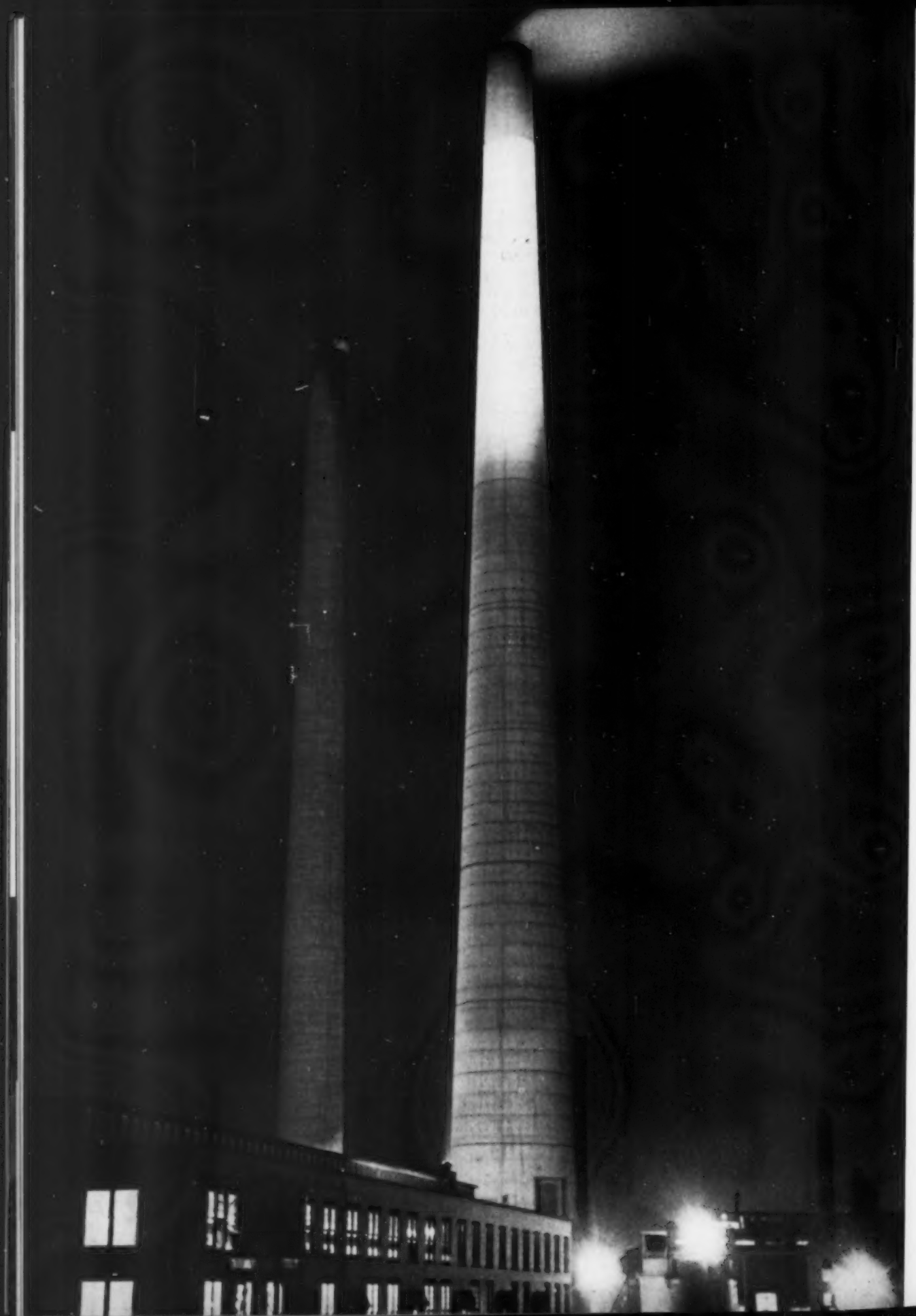
It would seem that the excavations are principally filled by a slow settling or levelling of the asphalt surface. An accurate survey made a few years ago showed that the general level of the lake had dropped some twenty feet in the last half century, during which period some five million tons of asphalt were removed.

The survey referred to disclosed a depth of two hundred and eighty-five feet at the centre, but the tonnage of asphalt in the entire lake has never been definitely estimated. There is, unquestionably, enough to supply the needs of the world for at least several generations to come.



Loading pier showing steamer taking aboard cargo of Trinidad Lake Asphalt.

Courtesy of S. J. Hayward





Left: Floodlighted at night for the benefit of passing planes, the refinery stack at Port Colborne stands like a sentinel on the shore of Lake Erie.

Right: Gold, like silver, platinum, palladium and other precious metals of the same family, is only a by-product in the nickel industry, even though the annual output equals that of many a good, sound gold mine. Pouring a gold bar in the Inco-owned Ontario Refining Company, Copper Cliff.

WHITE METAL MILESTONE

By **JAMES A. COWAN**

IN recent years, the word, "progress" has been more regularly used in reminiscences than in forecasts. The tendency has been to pay closer attention to economic worries than to satisfaction over sound accomplishments. But during these very years of doubt, one of this country's greatest industries has made a many-sided contribution of such importance that, had it been a single discovery by one solitary individual, it would have ranked him with the fabulous characters of science.

Canada has long led the world in nickel. This has been true for years, a matter of national pride and a fact which bred the not unnatural assumption that this leadership was wholly due to possession of the raw materials from which the metal came. That belief is just sufficiently true to be misleading and never as inaccurate as it is to-day. Originally it was correct. The Dominion won first place by virtue of the nickel-bearing ores found in the Sudbury area. But that place has been *held* and this country supplies 90 per cent of the present world requirements *because of the way in which these raw resources have been used.*

That does not begin to tell the story. It merely gives a little necessary background. In twenty years, the world demand for nickel has altered almost altogether; in the last ten, the industry and the uses of its product have changed so much that this can be considered as a tenth anniversary of an undertaking which traces its history back for more than sixty years,—the metal's most eventful decade, ten years of modern nickel.

When a Canadian refers to nickel, he may mean a coin, a metal or an industry. If he means the third of these, he is referring

Title for Pages 50 and 51—Some photographic impressions of the production and uses of Canadian nickel.



New cruisers of the Preventive Service, now that the Royal Canadian Mounted Police serve Canada afloat as well as ashore, use nickel alloys in galleys, showers, stern castings, Diesel engines.

to the International Nickel Company of Canada Limited which has been described as the Dominion's largest single industry and called Canada's greatest corporation so often that further repetition would be tedious. To include statistics showing the size, scope and variety of its operations would be to exclude all else. It has mines, smelters, refineries, foundries, rolling mills, research laboratories and 11,500 Canadians directly on its payroll. To International Nickel, anything else but nickel is a by-product including, in 1937, nearly 292 million pounds of copper, sufficient platinum to make Canada the world's chief producer, gold and other precious metals.

Now, to get these facts in focus and then obtain a clear perspective of a picture which is unique in industry anywhere, there is first Canadian dominance in one of the important items in the world of metals and, in this field, one corporation so successful as to be an industry of itself.

But twenty years ago, nickel was in the doldrums. The war demand had vanished and, according to some opinions, the industry would virtually vanish with it. Ten years ago however expansion plans were under way which would provide production facilities for much more nickel than the world had ever used or needed in any year of history. Whatever the future might hold, it was abundantly obvious that nickel had made a clean break with the past. Ten years later, the world demand required from Canada within one 12-month period, as evidenced by 1937, over 200,000,000 pounds of this white metal and Canada produced it.

Twenty years ago, nickel was used for coins, for plating, for armaments and little else. Ten years ago, the industry began to enter into its field of all-round service. If to-day every business which now finds nickel useful joined in marking the passing of this milestone, almost all modern commerce would be involved. Transportation by water, land and air leads a list of users which is to all intents and purposes, a catalogue of streamlined civilization. This most distinctively Canadian material is at work in agriculture, lumbering, in hospitals, in mining, architecture, in almost all the process industries whether concerned with food stuffs, dye stuffs, plastics, perfumes, textiles or leather, petro-



Right: Monel door frames, lintel and circular grille by Robert Mitchell Co. of Montreal. Bank of Canada Building, Ottawa, Ontario.

In the transformation of the steam locomotive from a heavyweight to a faster and more powerful unit, nickel steels and nickel irons are necessities.





A 300-foot freighter, Dolomite IV, made her maiden voyage on the Great Lakes this summer and is now in service on the Atlantic coast. Her holds are nickel-lined tanks. She can carry a load of caustic soda or kerosene in bulk, unload, clean her corrosion-resistant cargo spaces with steam and, a few hours later, load wheat.

leum products, paper-making, printing, in pickling metal parts and packing pickles. It is important to all classes of communication. The housewife uses nickel to peel potatoes and wash the dishes; the scientist in cooking vaccines and in fighting cancer.

Perhaps the simplest way to indicate the metal's wide-spread applications is to consider the case of an interested English visitor who made a trip to see the smelters. He sent a telegram to ask permission and, as he did so, it occurred to him that its delivery would require, at several points, equipment involving nickel. Taking a taxi to the station, he started making notes. The taxicab included nickel steels and nickel iron as well as nickel-chromium plating. He bought his ticket from a seller behind a Monel grille; boarded a train hauled by a nickel-bearing locomotive, using more nickel in its air-conditioning and equipped to serve meals from a kitchen fitted with nickel alloys. In tipping the porter a quarter, he thought he had broken the chain but recalled that silver too is, at Copper Cliff, a by-product of Canadian nickel.

Within the memory of comparative youngsters, this metal with a limited sphere of service has become a material of a million uses. Chief requirements of the job, still progressing rapidly, were intangible things, the idea, the determination to carry it out, the organization of the wholesale programme of study and investigation to produce results. Since these results have been spread out through industry after industry and accomplished piecemeal, developments destined to improve such dissimilar projects as the bus service to Bagdad and the building of Boulder Dam proceeded without benefit of the glitter, glamour or drama accompanying other achievements which were less important and less lasting. There was one single, simple, central theme. That, in a word, was alloys,—the application to metals of the ancient theory that in union there is strength. As it has now been demonstrated, there is not only added strength but other valuable characteristics including resistance to corrosion, durability, longevity, reliability, lighter weight and



Left: Monel stair rail by Robert Mitchell Co., Montreal. Door on landing by W. E. Dillon, Toronto, also of Monel. Bank of Canada Building, Ottawa, Ontario.

For long life, many hot water boilers for domestic use are now made of Monel, two-thirds of nickel, one-third copper. Looking through the interior of a boiler under construction.







Top Left: In the pre-refinery stages, purification and separation are carried out step by step in a variety of different furnace treatments.

Bottom Left: The last stage of refining, whether nickel or copper, takes place in a vast arena of electrolytic cells, acres in area, a whispering gallery where, as if in a great metallurgical green-house, crops of shining cathodes, sheets of the pure metal, grow to full size in the cells where the anodes have been planted.

Right: Like a swarm of mechanical birds, travelling cranes hover and swoop over the furnaces with a raucous clanging, carrying ladles in their talons.

Bottom: Step in pre-refinery stages.







Sunlight streaming through the smelter haze of Copper Cliff's converter aisle, longest in the world, along with the bursts of blazing light from the row of furnaces, creates light-and-shadow effects which have intrigued cameramen for years.

much-sought mechanical qualities of various kinds.

Starting with the known fact that Canadian nickel was a companionable metal, temperamentally inclined to join others to the great advantage of the new combination, better materials began to be available at a rate which brought memories of magicians pulling rabbits out of hats. The underlying situation was however that industry in a speeding civilization found its machinery had to meet steadily increasing strains and stresses, that there were obvious limits beyond which earlier materials could not stand up, that metallurgists including those of nickel took these problems to research and testing laboratories and thereafter there arrived with great rapidity, the age of tailored-to-measure metals. How far this has advanced and how great a role Canadian nickel plays is illustrated by a recent statement from the individual most concerned. Robert C. Stanley, president and chairman of the board of International Nickel pointed out that 8,200 alloys are to-day in use and that, of these, 2,300 contain nickel.

Of these, one alloy will have, in turn, a multitude of uses. There is for instance a library of technical information devoted wholly to the applications of Monel, a natural nickel-copper mixture, two-thirds nickel. Since nickel made its modern reputation as a partner, many of its great successes have been registered anonymously. Capt. George T. Eyston drove his "Thunderbolt" to set a new land speed record of 357.5 miles an hour. The steels, light alloys and bronzes used in the engines and elsewhere were no small factor in making this incredible pace a practical possibility and nickel was an important part of these. But at the time this streamlined monster monopolized the headlines, few people associated Sudbury with Utah's salt flats. The stainless steels are nickel steels. More and more cast irons, sold under various names, are irons containing nickel. The recent reasons why these alloys have been used include the redesigning of a well-known lawn-mower, improvement of the taste of maple syrup, invention of a combined plough and harrow, building of 35-ton trucks, electrification of Asiatic railways, bringing fresher fish to market, handling water-white kerosene in bulk and making rayon. As fast



Looking skyward through the manway to the tip of a stack 500 feet above at the Port Colborne refinery.



Because nickel is Canada's greatest single industry is one of the chief reasons why the Dominion dominates the world's nickel markets. Large-scale, efficient production made the metal economical to use, always available to industry the world over. One corner of Inco's giant smelter at Copper Cliff with an airline cutting across the foreground like a snake on stilts, the plant itself as tall as a 16-storey office building is dwarfed by the 512-foot brick stack in the background.

as such new uses are accepted, other still newer ones come along.

During depression years, marked on most calendars in red, this movement gained its momentum. To date, International Nickel has spent $18,750,000 developing new ways of service for a metal which Canada can supply indefinitely. When commerce was in a slump around the world and inertia was considered a progressive policy, this programme was in full swing.

Supplementing it, a huge expansion and construction programme was launched to handle the future orders which leaders of the industry foresaw resulting from their efforts. In May of 1930, a symbolic date for a symbolic event, a streamer of smoke drifted across the sky-line of Copper Cliff for the first time from the giant stack of Inco's greater smelter. Beside this chimney, 510 feet high, most modern skyscrapers are midgets and its completion was the visible proof that preparations for the industry's new era were almost finished. Since that time, in 1936, another stack, 554 feet high and thus the Empire's tallest building, has been added as well as one of 512 feet at the refinery in Port Colborne.

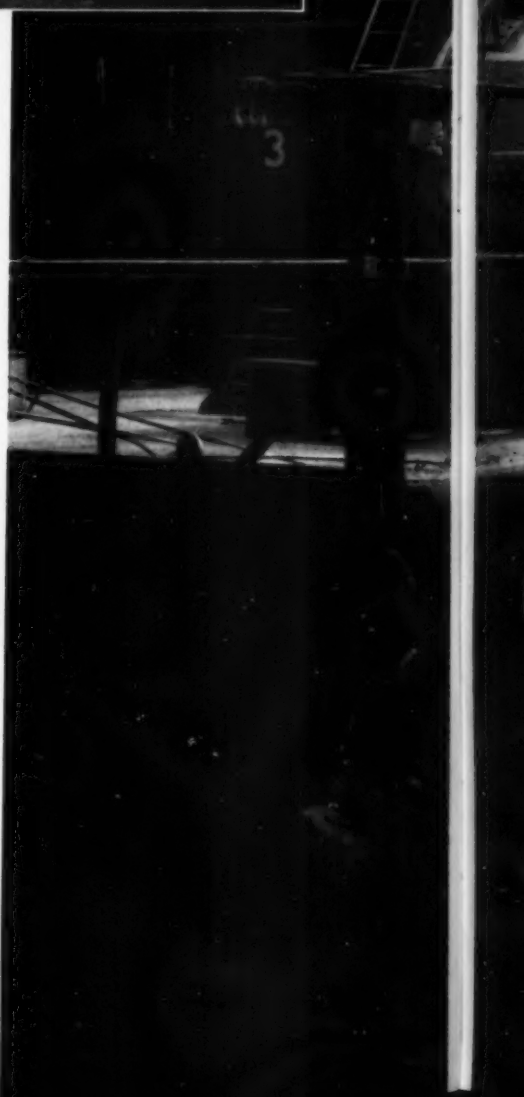


But that plume of smelter smoke is more important than statistics. Day and night the whole year round, without a pause or break, it always has continued ever since, visible to aviators thirty miles away, to northerners a sign-post of prosperity.

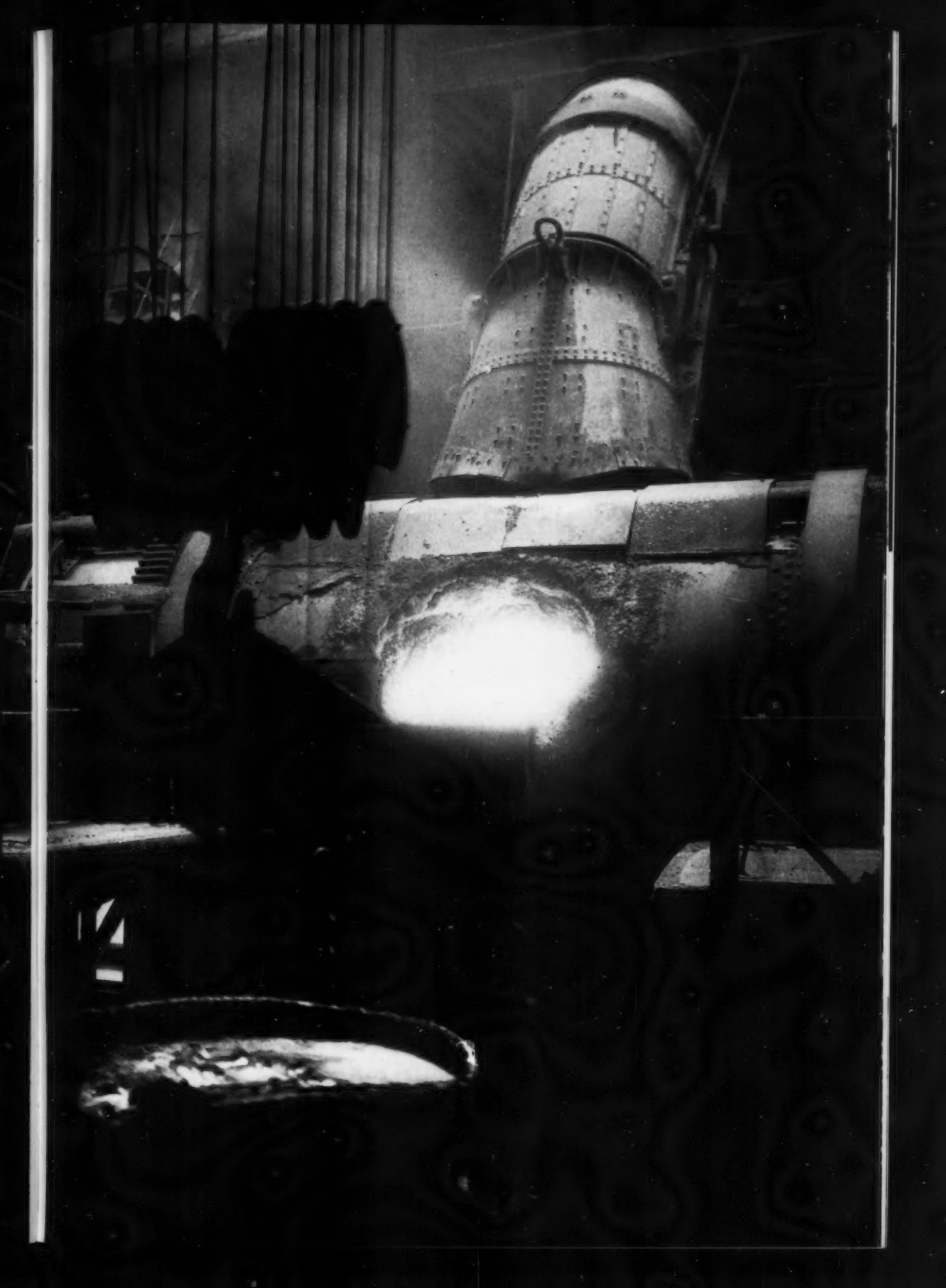
Copper Cliff, Ontario, is nickel's world capital. There is to be found the evidence of another reason why Canada holds its dominating lead. Nickel in unmined form is not uncommon and plenty of other spots on the earth's crust contain it. But nickel is not only mined; the metal is also manufactured and no one else has equal facilities or skill. In theory and fiction, prospectors stumble upon rich raw reserves of metal and all their troubles end. In fact, nature usually adds a handicap. Ores have to be treated by complicated, costly processes and Canada's nickel ores, as is well-known, were once considered nearly worthless due to the difficulties of separation. Smelter structures, concentrators, refinery buildings, offices and laboratories loom up at Copper Cliff like a range of hills. Batteries of grinders provide a steady background of synthetic thunder. In one huge industrial arena, acres of foaming troughs produce continuous crops of bright metallic bubbles. The converter

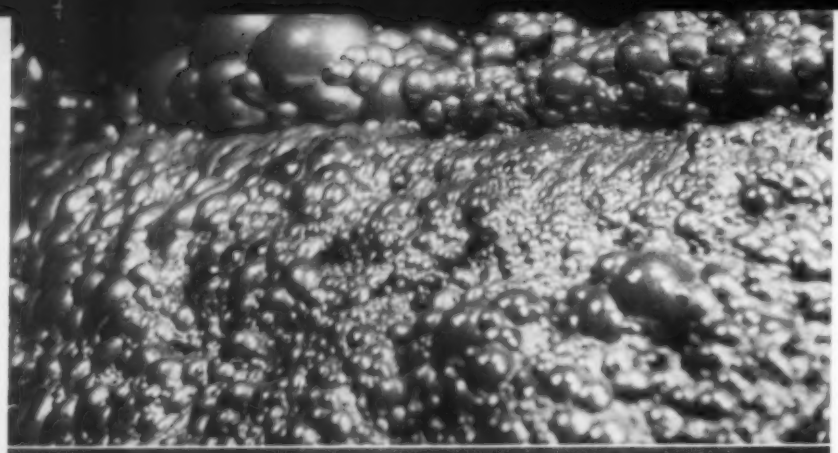


Above: Slanting beams of sunlight through a tracery of steel girders paint a pictorial background for the front ranks of a regiment of ladles in the Orford smelter at Copper Cliff.



Right: Manipulated as easily as if it were a tea-cup, this 10.5-ton ladle floats through the air down the converter aisle of the Copper Cliff smelter carrying 18 tons of molten matte.





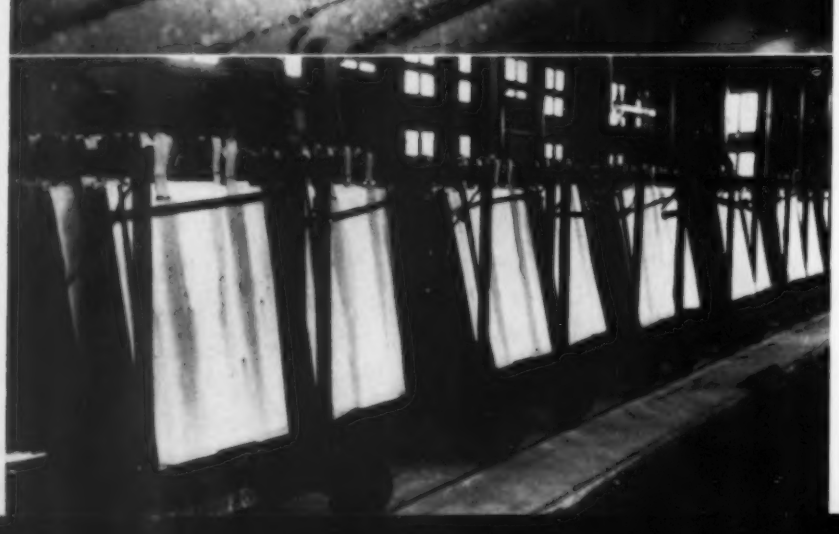
Nickel in the gleaming, metallic bubbles which foam over the trough-like cells in the Copper Cliff concentrator.



Nickel separated like the two halves of a layer cake from the accompanying copper material cooling on the floor of the Orford smelter. Here the difference in the two, before refining, can be clearly seen.



Nickel, like dull gray gravel, harrowed in a water-jacketted, cooling bed at Port Colborne.



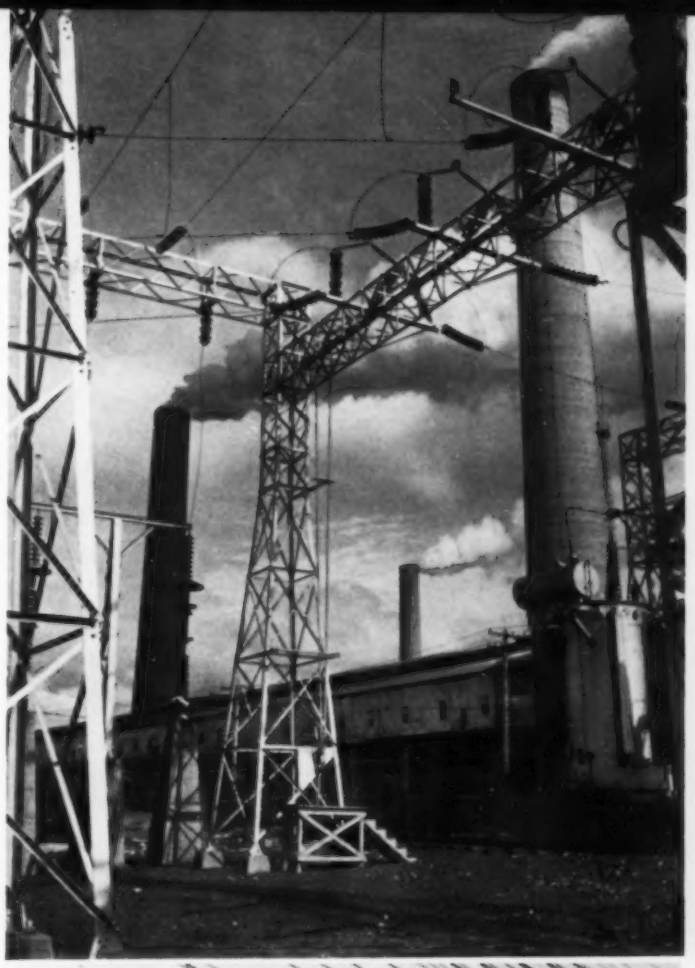
Huge, shining sheets of nickel with a deceptive soft lustre, as it is hauled in miniature trainloads from the electrolytic cells at the refinery.

aisle, a boulevard of furnaces over an eighth of a mile in length, looks like an avenue of miniature, steel-jacketted volcanoes. Ladles suspended from moving cranes, weighing as much as ten tons each and carrying eighteen tons of molten matte, float through the haze as gracefully as tea-cups. South, at Port Colborne on Lake Erie where the processes of refining are completed, silvery sheets of 99 per cent pure metal at last emerge after a 12½ day period of growth in a metallurgical green-house. In a vast gallery, silent except for the whispering trickle of solutions in a multitude of cells, cathodes of nickel are formed electrolytically.

As this broad stream of nickel flows out to industry at large from these parts of Canada, another inbound river matches it. Lumber from British Columbia, coal from Cape Breton, food stuffs from coast to coast for nickel's working army, purchases of materials and equipment from a never-ending list of needs make nickel and nickel's people one of Canada's biggest buyers as well as sellers. That is a phase of nickel's operations which most Canadians appreciate and understand. The influence of the industry cannot be exactly measured but, indirectly, its effect is felt by every one in the Dominion.

Equally understandable in view of nickel's widening fields of service, since industry everywhere depends on Canada for supplies, is the fact that this country uses only 1 to 2 per cent of its production. To sell the country's output, purchasers must continually be found for 98 to 99 per cent. Sales, too, will vary with business trends around the globe. In 1938, year of recession but also of rearmament, they slipped to some extent. Beginning 1939, with industry's activities increasing, they tend to rise.

Canada's—and International Nickel's policy has been to make this metal easily and economically available to any one who wishes it for peaceful purposes. Occasionally philosophical economists try to calculate how much more satisfactory the international outlook might now be if the same vision and the same sensible set of principles had been more generally applied to the development and control of essential raw materials.

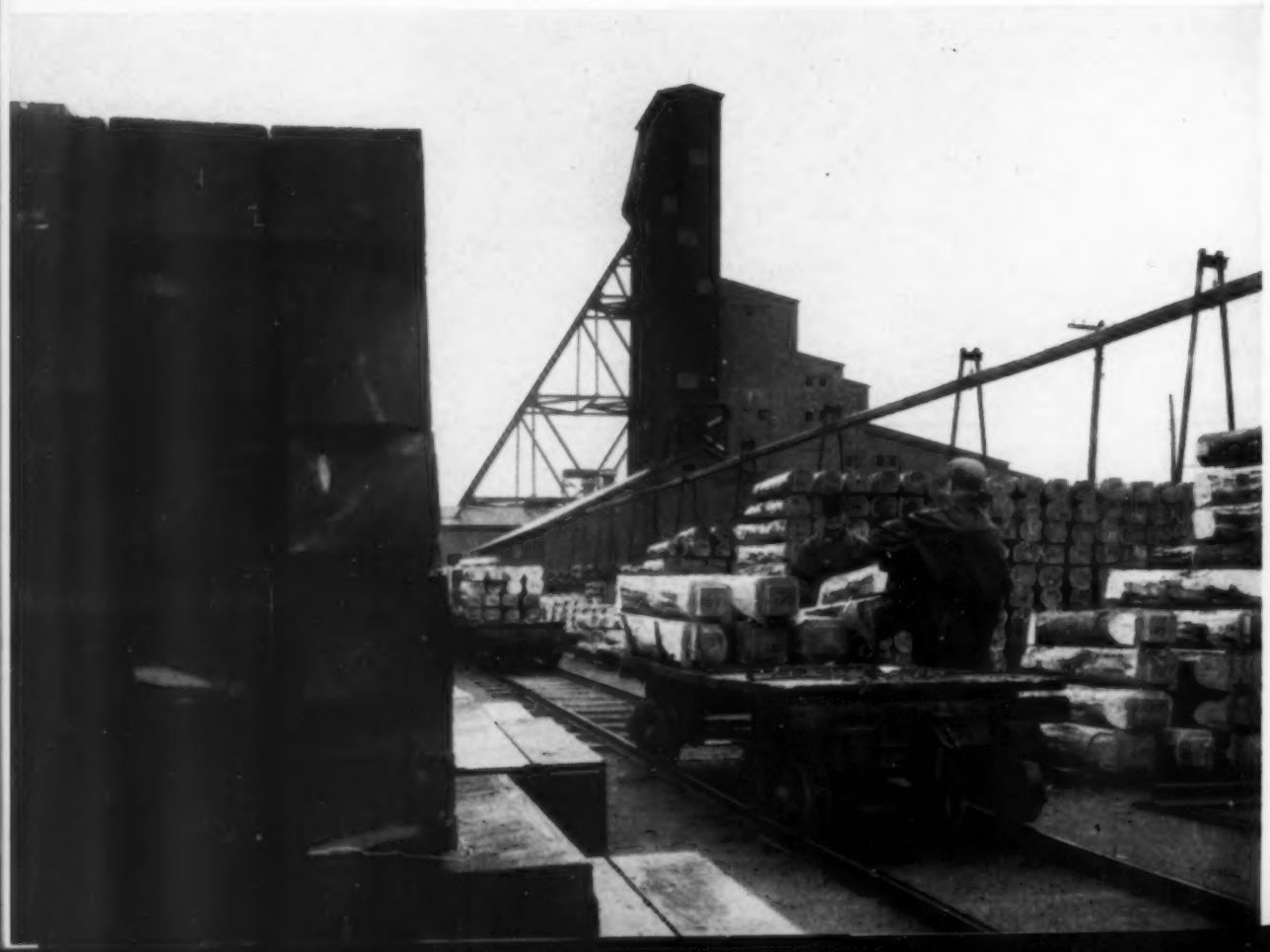


International Nickel is Ontario Hydro's biggest customer, a large purchaser of Nova Scotia coal, and a major customer for Canadian oil and lubricants.



No power is as important as manpower and most of Inco's 12,000 employees are Canadians.







Above: A new stack at Port Colborne climbs over the 300-foot mark en route to 500.

Top Left: Biggest post-depression industrial construction was the smelter and refinery expansion of International Nickel, a spending programme of over half a million a month for a year. One section of a smelter addition.

Bottom Left: For underground use alone, more than four million feet of timber a month, a large part from British Columbia. The surface timber yard at Frood Mine.



Anode pouring, Port Colborne. A spectacular operation now being surperseded by the more modern casting wheel as shown below.

Anodes, formed by pouring the molten metal into forms and cooling, instead of being done individually, are poured in series on a casting wheel.





Welder repairing interior of a 10-ton ladle in the Copper Cliff smelter.

Step in pre-refinery stages.






NICKEL
ALLIS-CHALMERS



A winter study in the Labrador Peninsula.



Ermine in native habitat.

THE FORGOTTEN LAND

The vast wilderness of the Labrador Peninsula

by **JACQUES FRANCINE**

ONE of the largest and most beautiful of Quebec's inland lakes is Lake St. John, one hundred and fifty miles north of Quebec City. This twenty-five-mile-wide lake is the head-waters of the famous Saguenay River, and marks the northern limit of colonization in the province of Quebec. North to the Arctic stretches a vast, unexplored wilderness called the Labrador Peninsula, sparsely inhabited only in certain regions by Indians and Eskimos and seldom visited by white men. Occasionally stories of great mineral wealth in the forest are told at the fur posts by the Indians, and they show rock samples to prove it, but when questioned concerning its whereabouts, they remain silent. Cree, Montagnais and Naskapi hunters bring down thousands of dollars worth of fur every year, and the Hudson's Bay Company rates this wilderness the finest fur country in all Canada. It is the home of ermine, marten, fisher, northern otter, Labrador mink and a host of other fur-bearing animals, whose skins eventually find their way to the great fashion centres of the world.

In the southern forests of the Labrador Peninsula, or the "bush" as the Canadian woodsmen call it, roams the gray moose which is longer of leg and leaner of flank than the round-bellied black moose of Southern and Eastern Canada. Here too is the woodland caribou and the black bear. Farther north on the barrens are the barren-land caribou or reindeer which migrate in vast herds, and upon which the Naskapi Indians and the Eskimos depend largely for their existence.

A. P. Lowe of the Canadian Geological Survey, who penetrated far into the interior many years ago, spoke of a tribe of Indians that never came down to the coast. They lived as primitively as they had for generations, never seeing or having any contact with whitemen. These were the Caribou hunters who depended entirely on this animal for their existence. Whether

they exist to-day or whether their food supply gave out remains a mystery. No one has bothered to find out. Likewise the Naskapi of the far North told stories of the size and ferocity of a bear that lived in the barrens. Occasionally they brought in skins of this animal to Fort Chimo on Ungava Bay, but apparently no white man ever saw a living specimen. What has become of this ghost-bear remains another unsolved mystery of the North; perhaps it is still to be found in the barrens of the Labrador Peninsula.

Getting into this almost inaccessible country is a problem. To travel by canoe for hundreds of miles up swift rivers and across wind-swept lakes requires months of back-breaking labour, poling up rapids, sweating over fly-infested portage trails and being eaten alive by mosquitoes and black flies in the muskeg swamps.

To travel by dog-team entails other difficulties and hardships. The dogs must be fed, and forever there is the fear of sickness and lameness to deplete the teams. The portages, swamps, rapids and insects are replaced by freezing winds, deep snow, intense cold, crust that cuts to the bone, snow-blindness and other difficulties encountered in winter travel in the North.

The only practical means of transportation is by aeroplane. Expensive? Yes, but not when measured in terms of time and supplies saved. The usual rate for flying in the North is sixty dollars an hour and the traveller pays the return trip regardless of whether or not he is returning. Flying in the North is difficult, especially in winter with seven and eight feet of snow in the forest and high drifts on the ice. Special equipment for heating the motor must be carried as well as the ever-ready emergency camping kit consisting of snowshoes, rifle, sleeping bag, food, etc.; in all about two hundred pounds besides the pay load. What maps there are of this country are inaccurate and weather reports are unavailable. From the air, the myriad lakes look exasperatingly alike and landmarks are obscured by deep snow. A fog and some bumpy air to toss the compass around, and even the most experienced "bush" flyer begins to have his troubles. A slight change in the temperature and fog covers the forest in a few minutes.

"Flying box cars" is the term used to describe the big transport ships of the North and they fit their descriptions to a nicety. Capable of carrying a ton or better, they leave no question as to choice of transportation to penetrate the wilderness. True, on longer flights the pay load must be reduced to make way for the precious gasoline, but even transporting a thousand or twelve hundred pounds of supplies in a comparatively few hours, as compared to months of labour accomplishing the same result by canoe, is worth the price.

The canoe brigades which for years were the only means of transporting supplies and furs to and from the Hudson's Bay Company's posts at Chibougamau and Mistassini and the outposts in this part of the North have been replaced by these flying box cars for the past two or three years. Only when the winter has been unusually hard on the Indians as it was during that of 1937-38 does the Hudson's Bay Company pay the Indians to portage supplies from the railroad (or the "Line" as it is called in the North) in order to help them establish credit for the following winter. Ten dollars per hundred-pound bag of flour is the cost of getting it by plane to their Mistassini post, two hundred and fifty miles by canoe from the nearest point on the line, Oskelaneo on the Transcontinental railroad. The Indians are paid the same price and a good "portager" can take as many as ten bags of flour if he is fortunate enough to own a canoe large enough to hold it all.

When you finally "get through", after unsuccessful attempts and days spent in waiting for the weather to clear, you find yourself in the northernmost hunting grounds of the Cree Indians. Only the most enterprising Indians travel so far from the post at Mistassini, three hundred and fifty miles by canoe to the southwest. It means leaving the post around the end of July and arriving at their destination, the head-waters of the Eastmain River, which flows westward into Hudson Bay, sometime around the middle of September. Already the small lakes and ponds are frozen over and in a few short weeks the forest will be in the grip of winter with the temperature occasionally dropping to sixty and sixty-five below, and the bitter northwest wind piling the snow into fifteen-foot drifts which will not begin to melt until the second week in May. Even in late April the temperature is sufficiently low to cause the sap in the trees to explode, making the sharp popping sound that is associated with a northern winter. According to the white trappers farther south,



Spring in the Labrador Peninsula. The lake near the head-waters of the Eastmain River where the writer and his trapper-companion spent two and a half months before paddling south with the Cree hunters in June.

when this occurs the temperature is at least thirty or thirty-five below zero.

The Crees who hunt in this region came from the south-west to gradually usurp the hunting grounds of the Naskapi, the more primitive Indians of the North. The Eastmain River is approximately the present boundary between the northernmost Crees and the Naskapi whose hunting-grounds lie in the far northern interior of the Labrador Peninsula. The Eskimos, age-old enemies of the Indians, are scattered along the north shores of the Labrador Peninsula from Hudson Bay to the coast of that part of the peninsula known as Labrador. In years gone by, bloody battles took place in the forest and on the barrens of Northern Quebec between these people, the Indians usually being the losers until they finally were able to procure from the fur traders fire-arms with which to wage unequal war upon their enemies.

Besides the Naskapi and the Crees there is another tribe of Indians who like the others, belong to the Algonquin family. These are the Montagnais who hunt in the forests around Lake St. John and along the east coast of Northern Quebec. The Labrador and North Shore Montagnais are a finer lot of Indians than their neighbours, the Naskapi, but unfortunately proximity to civilization, such as may be found near Lake St. John, has not contributed to their qualifications for good citizenship.

It has been over two centuries since the Hudson's Bay Company established their first post at the mouth of the Rupert River and named it Rupert House in honour of Prince Rupert, one of the founders of the "Company of Gentlemen Adventurers trading into Hudson Bay" and during that time there has been much infiltration of white blood into the Indian tribes of the North. As a result there are few of the Crees who do not show some trace of it. They have become semi-civilized and no longer practise many of their ancient rites and customs. However, despite the Anglican missions, they occasionally revert to their caribou-skin drums and weird chants to supplement their Christian faith. When a child is born and if a white man is available, he is asked, as the writer was, to baptize the child in the Christian manner, but to make doubly sure that no harm shall befall the infant, the heathen baptism is performed as well. This takes place at night. The men sit in a circle in the teepee, chanting in low voices; the chief among them beats



Transport plane bringing welcome supplies.

a caribou drum while the women and girls dance in the centre of the ring, keeping time with the drum, all the while entreating the Great Spirit to be kind and good to the newest arrival.

A strong superstition of the Indians concerns the death of one of their members. They are very much afraid of death and the dead. Never again will they camp at a place where they know some one has died, not even if the death occurred in a newly built cabin as was the case near Lake St. John. The Indian in question, a Montagnais, had spent many weeks building a cabin for his young wife who proceeded to die the day it was completed. The husband never returned nor has any one else, and the cabin stands deserted on a desolate lake shore, sheltering only the spirit of the dead squaw who lies buried a short distance away inside a small picket enclosure to keep out the wolves and foxes.

Occasionally in the forest, far from a post, the Crees gather for a ceremonial dance which has seldom been witnessed by a white man. Perhaps they are afraid that a white man will tell the minister at the mission, or perhaps the Indians feel that the presence of a white man would break the spell.

The Crees as a rule take their Christian faith quite seriously, even to the extent of saying their prayers each night. The Bible, hymns and psalms have been translated into the Cree language and written in their strange but simple writing. Every Sunday and on Christmas and Easter, the head-man of each family, no matter how remote in the wilderness, will read lengthy chapters from the Cree Bible while his family gathers around him in the teepee, dressed in their Sunday best. No work is indulged in on Sunday or the two Great Days except if the "old man" happens to be away on his trap line; then the younger ones play truant. But this occurs very seldom, and for hours on end they will sing the Anglican hymns learned at the mission, in wild, tremulous voices that seem to echo the very soul of the forest in all its vast loneliness.

The lives of these northern Indians are completely governed by trapping. From September until the following June they are on their hunting grounds. For a short period during the summer they gather at the various trading posts scattered along the coast of Hudson Bay and at Mistassini and Chibougamau. They trap to obtain food and supplies with which to live during the following winter, so that they may obtain furs with which to buy more food for the following year. It is a cycle which has no end.

The Indian hunters leave the trading posts as early as the end of July and travel by canoe with their families to their distant hunting-grounds. These hunting-grounds may average anywhere from two hundred to four hundred square miles to a family. By the unwritten code of the North, no one else may set a trap in a region already claimed. Occasionally the white trappers farther south try it only to have their traps closed by the Indian hunter as soon as they are discovered and many a battle has followed in the wilderness as a result.

The factors are obliged to do the thinking and worrying for the Indians. Contrary to popular belief, the object is not to increase an Indian's debt, but to keep it as low as possible so that he will be able to live within his income, which in

Making spruce paddles.



Cree Indian helping his squaw stretch a new caribou skin, before tanning.



this case is the average amount of fur that a hunter brings in year in and year out. To permit an Indian to get himself hopelessly in debt is not only poor business but also creates bad feeling. All summer long the factors have to keep a continual check on each hunter to make certain that he keeps enough credit to be able to leave for the bush in the early fall with at least enough food to keep himself and his family from starving during the long winter when game may be scarce.

Between the Indians exists an unspoken agreement to help one another whenever the necessity arises, especially with regard to food, the all-important item in the North. It is not uncommon for a hunter to travel hundreds of miles on snowshoes to take food that he can ill-afford to spare to a starving neighbour. It is natural, then, for them to expect the Company and the free traders to give them food in unrestricted amounts when they feel that they need it, regardless of how much debt they may have. But when one considers that every pound of provisions has been transported for hundreds of miles, sometimes at rates as high as thirty-five cents a pound, a stock at a post represents a sizable investment, one that has to be doled out carefully to even clear operating expenses. Thus it is out of the question to give unlimited credit to an Indian who is already far in debt, not only from a financial standpoint, but also because it would set a bad precedent for the others.

The term, "Hudson's Bay" Indian, is well used. Free-traders may come and go, individuals along the fringes of civilization may cheat and rob the Indians whenever the opportunity presents itself, but the Indians know that the Company has always been there and probably always will be.

It would be hardly fair to dwell entirely on the hardships encountered in this little-known land without mentioning some of its pleasant aspects. Few places in the world can be more peaceful and more beautiful than the Labrador Peninsula. There are days during the winter when the traveller can dispense with gloves, helmet and parka, and sing in rhythm with the snowshoes as they kick up a fine powdery spray from the fresh snow. The whole forest glistens in the warm, morning sunshine.



Typical Indian family.

Later, when the snow has gone in May and there is a short month before the flies arrive, the northern traveller can walk miles through the forest, unhampered by underbrush with only caribou moss underfoot, soft as a Persian rug, upon which his footprint remains visible for many weeks. There are giant trout and pike to try one's rod and perhaps if you are quiet, a beaver, an otter, a muskrat or a bear might appear along the water's edge.

But the loveliest time of all is in September and early October. The flies are gone, except on very warm days and then only for a short time around noon. There is a nip in the air. The deep blue of the water contrasts sharply with the vivid foliage of the hardwood trees and swamp alders, and at night the milky way and northern lights are things at which to marvel. The deep-throated bellows of the bull-moose silence the yapping of the foxes, and in turn are silenced by the howls of the big wolves as they sit on their haunches on a nearby ridge and point their muzzles to the Labrador moon.

The portage.



An Indian hunter stretching an otter pelt.



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EDITOR'S NOTE-BOOK

Don Munday, the author of "The Rainbow Mountains in Tweedsmuir Park," published in this issue, is well known to readers of the Journal. A journalist by profession, he has lived in and around the coastal range of the Rocky Mountains. Mr. Munday spent the past summer in the Rainbow Mountains and Bella Coola district securing exclusive photographs and data for his article.

Hoyes Lloyd M. A., who recently contributed "Some Aspects of Canadian Bird-Life" wrote "Lorene Squire Studies Prairie Birds" which appears in this issue. For the past twenty years he has been the Superintendent of Wild Life Protection, National Parks Bureau, Lands, Parks and Forests Branch, Department of Mines and Resources Ottawa. In May 1938, in Rouen, France, he was elected Vice-Chairman of the International Committee on Bird Preservation. Mr. Lloyd is a Fellow of the New York Zoological Society and of the American Ornithologists' Union as well as a member of many other natural history and conservation organizations.

Jacques Louis Francine, who contributes "The Forgotten Land" was born in Philadelphia, Pennsylvania. He studied geology at the University of Wyoming and Dartmouth College and graduated from the latter in 1937. Mr. Francine led an expedition to collect mammals in the Labrador Peninsula for the Academy of Natural Sciences of Philadelphia in the early spring of 1938.

ERRATA — DECEMBER ISSUE

Bottom of pages 289—290, transpose captions.

ANNUAL MEETING

Canadian Geographical Society

The Society will hold its Annual Meeting in the Lecture Hall of the Victoria Museum, Ottawa, on February 15th, 1939 at 5:30 p.m. Dr. Charles Camsell will deliver his Presidential Address Friday, February 24th, at the Museum. His subject will be "The Yellow Knife Mining District" which will be illustrated by lantern slides and motion pictures.

AMONGST THE NEW BOOKS

Canadian Mosaic, the Making of a Northern Nation, (Toronto: McClelland and Stewart, 1938, $3.50) is perhaps the most notable book yet written by its versatile author, JOHN MURRAY GIBBON. As the preface says, "Changes in international boundaries in Europe due to racial problems are of vital concern to Canada, since so large a proportion of the Canadian population has originated in disturbed areas and has crossed the Atlantic to escape from the effects of changes in past years. It seems therefore only right that Canadians should make themselves familiar with the countries from which they have come and the reasons why their forebears have taken up Canadian Citizenship". In this book they have ready to their hand a comprehensive study of each racial group, its history, and the splendid contributions of traditions and culture each has contributed, and is contributing, to the growth of our nation. There is a vast deal of history in these pages and many concrete examples of individual and group achievements which will open the eyes of many readers to the richness and colour added to our national life by these various racial types. Numerous photographs and reproductions of historical paintings and portraits enliven the pages, while illustrations in colour by Kathleen Shackleton, W. J. Phillips, Nicholas de Grandmaison and other well-known Canadian artists depict "New Canadian" types and handicraftsmen, very strikingly. The poems and folksongs scattered throughout the book are foretastes of the rich harvest of literary gifts these old world races have brought to our shores. Many of them are the skilful translations of Watson Kirkconnell, Florence Randall Livesay, and others, while a very large number are quoted from Murray Gibbon's own collections of ballads and "Northland Songs". To national melodies of haunting beauty from old world countries he has written charming songs which one is tempted to quote. A singularly appropriate one set to the Russian "Song of the Emancipation of the Serfs in 1861" is called Song of an Immigrant.

"I have wandered from a far land that I may
not see again,
Where the rulers of the country think of
soldiers, not of men,
And they herded us in barracks like the cattle
in a pen.

Where our thought was left unspoken lest to
tyrant it were known,
Where a sword was but a token that our life
was not our own,
Where the heart that was unbroken was as
hard as any stone.

By the river, over prairie, on a coast of sand
and foam,
Through the forest, on the mountain, by the
lakeshore, let me roam,
In a free and wide Dominion let me live and
be at home."

Animal Heroes, Stories of Wild Life (London: Duckworth, 1938, $1.25). Harper Cory has in this attractive little book portrayed three wild animals which displayed courage and patience when confronted with circumstances inimical to their freedom and existence. The story of the Snowshoe rabbit is based entirely on Mr. Cory's own observation in the field. That of Silvertip, the valiant grizzly bear was based on a thrilling story told to the author by a Sioux Indian friend, while Flagtail the deer, was patiently stalked for many seasons by Mr. Cory's camera. He says, "Flagtail lived in the East . . . his earlier vicissitudes had made him extremely man-wise, and although my experience of the species was not small, I counted myself furtunate whenever I detected the creature through field glasses". There is an irresistible appeal in these stories which is heightened by Miss Erna Pinner's imaginative and delightful animal drawings.



Wild Animals in Britain, by FRANCES PITT (London: Batsford, 1938, 8/6 net) is another volume of the British Nature Library uniform with those on British birds and flowers which have recently been reviewed in this column. It is characterized by the same intimate knowledge, readability, and excellent photographic illustrations. The foxes, rabbits, otters, badgers, weasels, hedgehogs, bats, moles, squirrels, mice and all the other British wild animals are described by one who has studied them scientifically and known them as a friend, for the author has had some strange pets. The accounts of their features, characteristics and habits are constantly and delightfully interrupted by an anecdote or a story illustrating some peculiar trait. A unique feature of the book is the series of reproductions of the quaint old woodcuts by THOMAS BEWICK, which were considered marvellous pictures of wild animals in 1790 when his History of Quadrupeds was published.

F. E. FORSEY.

HON. PAUL LEDUC,
Minister of Mines.

ONTARIO

H. C. RICKABY,
Deputy Minister.

PROVINCE of ONTARIO

Department of Mines.

TORONTO

RECENT REPORTS

ANNUAL REPORT, VOL. XLVI - 1937

Part 1. Statistics of Production (Finally Revised), List of Mines, Mining Accidents in Ontario and Prospectors Classes (1936).

Part II. Geology of the Horwood Lake Area, with map No. 46a, by W. D. Harding.

Part III. Geology of the Northern Long Lake Area, by H. W. Fairbairn, Geology of the Pagwachuan Area, by R. D. Macdonald, with map No. 46b.

Part IV. Geology of the Stull Lake Area, by J. Satterly. Geology of the Sachigo River Area, by V. B. Meen, with map No. 46c.

Part V. Natural Gas, 1936, Petroleum, 1936, with map No. 46g. showing Natural Gas Fields in Southern Ontario, by R. B. Harkness.

Part VI. Geology of the Superior Sturgeon Lake Areas, by H. C. Horwood with map No. 46d, also map No. 46e for Alcona-Split Lake Area.

Part VII. Geology of the Casummit Lake Area and the Argosy Mine, with map No 46f, by H. C. Horwood.

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Of the Nine Parts in Preparation

Part I. Statistical Review, 1937, (Revised), available, January 1939.

Part III. The Crow River Area and The Uchi Lake Area, by J. E. Thomson, available in January 1939.

Nap No. 47b of Crow River now available

Map No. 47c of Uchi River now available

Part VII. Geology of the Sandy Lake Area, by J. Satterly, available February, 1939.

Map No. 47f of Sandy Lake now available.

Geology of the North Spirit Lake Area, by J. D. Bateman available February, 1939.

Map No. 47g of North Spirit Lake, now available.

Recent Developments in the Favourable Lake Area, by J. D. Bateman.

Other Maps — (Accompanying Reports now in preparation).

Map No. 47a Porcupine Area, by M. E. Hurst, available in March, 1939.

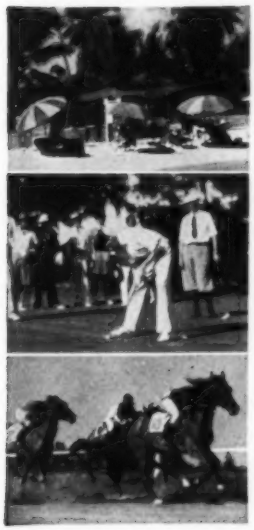
Nap No. 47d Keefer-Eldorado Area, by W. D. Harding and L. G. Berry, now available.

Map No. 47h South Onoman Area, by W. W. Moorhouse, available in January, 1939.

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INDIANS HARVEST RECORD CROP

Indian farmers living on the Blood Reserve, Cardston, Alberta, harvested a record grain crop this year, according to the Department of Mines and Resources, Ottawa. With threshing operations completed, the total grain yield on the reserve is reported at 255,411 bushels, comprising 202,193 bushels of spring wheat, 6,335 bushels of fal wheat, 6,936 bushels of fall rye, and 39,947 bushels of oats.

As threshing proceeded and the fields were cleared, some 700 acres were again seeded to fall wheat for next year's crop. In addition, 8,500 acres of summer fallow has been cultivated by tractors and horses, and are in readiness for spring seeding.

Farming and livestock-raising are the principal occupations of the Indians on the Blood Reserve, and their achievement in harvesting more than one-quarter of a million bushels of grain reflects the progress being made in Indian rural rehabilitation in Canada. Originally these people subsisted in moderate comfort upon the harvest that nature provided, but with the settlement of the prairies and the accompanying depletion of game resources, the Indians were forced to turn to agriculture in order to support themselves. After twenty years of farming, the Indians on the Blood Reserve have made good and are among the most prosperous and self-reliant of Canada's Indian population.